EXCAVATION OF THE TWO GUYS SITE (7S-F-68) SUSSEX COUNTY, DELAWARE

DELDOT PROJECT 88-013-01

DELDOT ARCHAEOLOGY SERIES NO. 138

FHWA FEDERAL AID PROJECT NH-5005(1)

By

Charles H. LeeDecker
Brad Koldehoff

THE CULTURAL RESOURCE GROUP
LOUIS BERGER & ASSOCIATES, INC.
100 Halsted Street
East Orange, New Jersey 07019

with

Cheryl A. Holt
Analytical Services for Archaeologists
Alexandria, Virginia

Submitted To

U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration

and

DELAWARE DEPARTMENT OF STATE
Division of Historical and Cultural Affairs
Bureau of Archaeology and Historic Preservation

Prepared For

DELAWARE DEPARTMENT OF TRANSPORTATION
Division of Highways
Location and Environmental Studies Office

Eugene E. Abbott
Director of Planning

1996

Doc. Con. No.
55-03/96/8/19

ABSTRACT

The Cultural Resource Group of Louis Berger & Associates, Inc. (LBA), has conducted an archaeological data recovery program for Site 7S-F-68, located in Sussex County, Delaware. This program was sponsored by the Delaware Department of Transportation (DelDOT) prior to the dualization of U.S. Route 113 between Georgetown and Milford.

The project research design focused on issues of prehistoric chronology, subsistence, settlement patterns, intrasite patterning, environmental adaptation, and technology. The principal episodes of site use occurred during the Archaic and Woodland periods, but there is also evidence that Paleoindian groups visited the site. The first period of frequent site use occurred during the Early Archaic period (circa 8000 - 6000 BC), followed by a period of infrequent use during the Middle Archaic (circa 6000 - 3000 BC). The second period of intensive site use occurred during the Late Archaic (circa 3000 - 1000 BC) to Early Woodland (circa 1000 - 500 BC) periods, followed by sporadic visits during the Middle Woodland (circa 500 BC - AD 800). Use of the site during the Late Woodland (circa AD 800 - 1600) may have continued almost until the period of European contact.

The site occupies a low, sandy ridge surrounded by extensive upland wetland areas, and it appears to have been used on a seasonal basis for procurement and processing of upland game and plant resources. Very little faunal material was preserved at the site, but flotation samples contained an important early cultigen -- sumpweed *(Iva annua)* -- as well as a few other economically important floral resources. A limited variety of features was present within the site, and only one formal cooking/heating area was identified. There were also a number of informal cooking/heating areas, as well as tools and activity areas apparently related to plant food processing, tool maintenance, and generalized processing tasks.

The artifact assemblage consisted primarily of lithic tools and debitage, together with a small amount of pottery. Analysis of the lithic assemblage focused on issues of technology, function, style, and raw material selection and procurement. An extensive program of residue analysis was also undertaken. Located in the Mid-Peninsular Drainage Divide zone, the site vicinity lacks a source area for lithic raw material; nonetheless, analysis indicated that the groups that visited the site made extensive use of cobble deposits that were scattered throughout the Delmarva Coastal Plain.

The site also contained a small family cemetery used during the late eighteenth century. DelDOT authorized a separate excavation program for the human burials, and the excavation and analysis of the cemetery is presented in a separate report, DelDOT Archaeology Series No. 134 (LeeDecker et al. 1995).

DelDOT Archaeological Series Index Information

This form is intended to provide information on the contents of this volume for indexing. It is also intended for researchers to use to check the research methods and topics included in this volume.

Report Title: **EXCAVATIONS OF THE TWO GUYS SITE (7S-F-68), SUSSEX COUNTY, DELAWARE**

DelDOT Report Number: **138**

Level of Investigations: [Phase I, II, III, Planning Survey, Specialized Study]

Phase III

Basic Time Periods Covered:

X	All prehistoric
	Mainly prehistoric, some historic
	Equal coverage of prehistoric and historic
	Mainly historic, some prehistoric
	All historic

Site Contexts:

	Prehistoric	Historic
Plowzone/disturbed surface soils	**X**	
Intact features	**X**	
Buried artifact-bearing strata	**X**	

List up to five major time periods or site types:

1. **Archaic Procurement Site**
2. **Woodland Procurement Site**
3.
4.
5.

List up to eight major topics covered in Conclusions and Discussions of Results

1. **Prehistoric chronology**
2. **Subsistence Patterns**
3. **Settlement Patterns**
4. **Floral Analysis**
5. **Environmental Adaptation**
6. **Lithic Technology**
7.
8.

Specialized Analyses Undertaken

	Prehistoric	Historic
Blood Residue	X	
Ceramic Chronology		
Ceramic Vessel Surface Alterations		
Cordage Twists from Ceramic Impressions		
Faunal Analysis	X	
Floral Analysis	X	
Flotation	X	
Geomorphology and Pedology	X	
Glass Analysis		
HABS Documentation		
HAER Documentation		
Historic Architecture		
Informant Interviews		
Leather Analysis		
Miller Ceramic Index		
Mortar Analysis		
Palynology		
Projectile Point Chronology	X	
Projectile Point Function		
Radiocarbon Dates	X	
Soil Chemistry	X	
Spatial Distribution of Artifacts	X	
Stone Tool Function Analysis	X	
Wood Identification		

List up to 5 other specialized analyses not listed above

Geographic Area Covered

______	New Castle County
______	Kent County
X	Sussex County
______	All State

ACKNOWLEDGMENTS

The Cultural Resource Group of Louis Berger & Associates, Inc. (LBA), wishes to express thanks to the various individuals who provided guidance, advice, and assistance at various stages of this project. Numerous Sussex County residents facilitated the archaeological fieldwork by allowing access to their property or by providing information pertaining to the area's prehistory. Mr. Gene Spatz, owner of the Redden Auto Center, was especially helpful during the field excavations.

The Delaware State Historic Preservation Office (DESHPO) provided an important oversight role and responded quickly to all requests for consultation and guidance. The DESHPO staff who assisted in the project include Daniel Griffith, Joan Larrivee, Alice Guerrant, and Faye Stocum. Faye Stocum was particularly helpful during the fieldwork phase of the project.

The Delaware Department of Transportation (DelDOT) and the Federal Highway Administration (FHWA) also provided important assistance. Individuals associated with these organizations who provided assistance during the project include John C. Gilbert (FHWA Division Administrator), Robert H. Wheeler (FHWA Realty/Environmental Specialist), Kevin Cunningham (DelDOT Archaeologist), Raymond D. Richter (Assistant Director, DelDOT), Joseph T. Wutka, Jr. (Location Studies and Environmental Engineer, DelDOT), Raymond Harbeson (Chief Engineer/Director, Division of Highways, DelDOT), Terry Fulmer (Manager, Environmental Studies, DelDOT), Joy Mengel-Ford (DelDOT Environmental Planner), Rod S. Hill, Jr. (Chief, Right-of-Way, DelDOT), Allan Redden (South District Engineer, DelDOT), Jeff R. Reed (South District Maintenance Engineer, DelDOT), Gary Redden (Traffic Signal Supervisor, DelDOT), Carol L. Kates (DelDOT Secretary), and Joanna Likens (DelDOT Project Scheduling and Coordination).

The Cultural Resource Group of LBA had direct responsibility for the study. The LBA staff was under the general supervision of John Hotopp, Group Vice President. Charles LeeDecker served as Principal Investigator for the project, with overall responsibility for research design, field excavation, and report preparation. Kimberly Kratzer and Bradford Botwick served as Field Supervisors, with the assistance of Rick Vernay, Crew Chief. The field crew members included Lisa Adams, Nathaniel Bailey, Gary Charyak, Lisa Elsinger, Kathy Fobes, Sharon Hogue, Rob Jacoby, Charlene Keck, Alan Kinner, Andria Kinner, Paul Friedman, Yvonne McCanns, and Madge Smith, assisted by Charles Dunton, Logistics Coordinator, and Jack Goudsward, Assistant Logistics Coordinator.

Sharla Azizi, LBA's Laboratory Director, and Nadia Maczaj, Assistant Laboratory Supervisor, oversaw the cataloging of the artifact collections. Brad Koldehoff, Material Specialist for Prehistoric Lithics, had primary responsibility for the lithic analysis, and he was assisted by Beverly Boyko, Ronald Kearns and Byron Simmons, who served as Laboratory Assistants. Alex Ortiz had responsibility for preparation of the computer database. Other laboratory processing tasks were completed by Christine Ahlstrom, Ruby Arquiza, Janet Bjugan, Melissa Grieves, Devon Houlker, Jennifer Pendergrass, Gregorio Sangalang, John Ra, Ritchwell Suayan, and Christine Szoke. Editing and production were performed by Lee Nicoletti (Production Supervisor), and Suzanne Szanto (Editor). The illustrations were prepared by Jacqueline Horsford (Drafting Supervisor). The photographic plates were prepared by Rob Tucher.

Some specialized studies were undertaken by consultants. Cheryl Holt of Analytical Services for Archaeologists was responsible for the flotation analysis. The University of Delaware Center for Archaeological Research and Paleo Research Laboratories of Golden, Colorado, conducted tests for immunoglobin residues on the lithic artifacts, and Gerald Kelso conducted tests for pollen on two milling stones. Daniel Wagner of Geo-Sci Consultants, Inc., conducted a study of the site's geomorphology and local pedological conditions.

From the Division of Support Operations: Bill Yerkes, Graphics and Printing Manager, Jim Sylvester, Printer III, Ed Wilkinson, Printer III, Kate David, Graphics Specialist III, Robert J. Zullo, Graphics Specialist II, Justina Brewington, Photo Reproduction Technician.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

I

INTRODUCTION

The Cultural Resource Group of Louis Berger & Associates, Inc. (LBA), has conducted an archaeological data recovery program for Site 7S-F-68, located in Sussex County, Delaware. This program was sponsored by the Delaware Department of Transportation (DelDOT) prior to the dualization of U.S. Route 113 between Georgetown and Milford. The study has been carried out in accordance with the instructions and intents of Section 101(b)(4) of the National Environmental Policy Act; Section 1(3) and 2(b) of Executive Order 11593; Section 106 of the National Historic Preservation Act; 36 CFR 771, as amended; the guidelines developed by the Advisory Council on Historic Preservation published November 26, 1980; and the amended Procedures for the Protection of Historic and Cultural Properties as set forth in 36 CFR 800. As a recipient of funding from the Federal Highway Administration, DelDOT undertook this investigation to comply with federal cultural resource management policies that require consideration of the effects of construction on significant historic or prehistoric resources. DelDOT's commitment to undertake this program was formalized in a Memorandum of Agreement involving DelDOT, the Delaware State Historic Preservation Officer, the Federal Highway Administration, and the Advisory Council on Historic Preservation.

The proposed dualization of U.S. Route 113, also known as the Du Pont Highway, will involve new construction from a point just south of Milford, near Herring Branch of Mispillion Creek, to just north of Georgetown, near Route 18. North of Milford, U.S. Route 113 diverges from Route 1 and runs parallel to, and midway between, Routes 1 and 13 through Sussex County. Between Milford and Georgetown, the existing alignment passes near the towns of Lincoln, Ellendale, and Redden. The dualization will provide two additional 12-foot lanes, 10-foot shoulders, and a median area. The existing right-of-way averages 200 feet throughout the corridor, and for the most part this is sufficiently wide to permit the new construction without the taking of additional right-of-way. Plate 2 illustrates the site location near Redden.

The archaeological data recovery program described herein follows two earlier survey and site evaluation studies. Site 7S-F-68 was initially identified during a Phase I archaeological survey of the entire Route 113 corridor between Milford and Georgetown (LeeDecker et al. 1989). The site was identified on a small knoll which extends westward outside of the highway right-of-way and to the north where it has been disturbed by construction of an automobile repair shop. Following completion of Phase II testing in 1991, the site was determined eligible for the National Register of Historic Places (LeeDecker et al. 1992). Because the site will be destroyed by the planned dualization of Route 113, DelDOT sponsored a program for mitigation of adverse effects through archaeological data recovery.

This report is organized into nine chapters. Chapter II outlines the prehistoric context and includes a summary of the previous work at Site 7S-F-68 and an overview of regional prehistory. Chapter III, which describes the site's environmental setting, presents the results of a geomorphological and soils study of the site. The project research design, in Chapter IV, includes a discussion of the principal research issues and their relationship to the Delaware State Plan for Management of Archaeological Resources. Chapters V, VI, VII, and VIII describe the results of the excavations at Site 7S-F-68, including a discussion of the features (Chapter V), a discussion of site formation processes and cultural components (Chapter VI), the artifact analyses (Chapter VII), and the floral and faunal analyses (Chapter VIII). The concluding chapter summarizes the results of the study according to the principal research topics and relates the findings to regional prehistory and issues identified in the State Plan for Management of Archaeological Resources.

Fieldwork for the data recovery program was carried out over a six-week period from April 20 to May 1, 1992. The excavations were completed by a field team that included, at times, as many as 14 persons. The excavation strategy consisted of three principal components: (1) excavation of block areas centered on productive areas of the site identified during the Phase II fieldwork (2) exploratory excavations to provide a better spatial sample of the site area, and (3) expansion of block areas to recover significant features and deposits expected to be identified during the exploratory excavations. Altogether, the Phase III excavations involved a total of 46 excavation units, encompassing an area of 173 square meters. The overall sample from the testing and data recovery phases is equivalent to approximately 28 percent of the estimated site area within the right-of-way.

During the Phase III data recovery excavations, five historic human burials were identified unexpectedly. Upon exposure of human remains, a report was filed

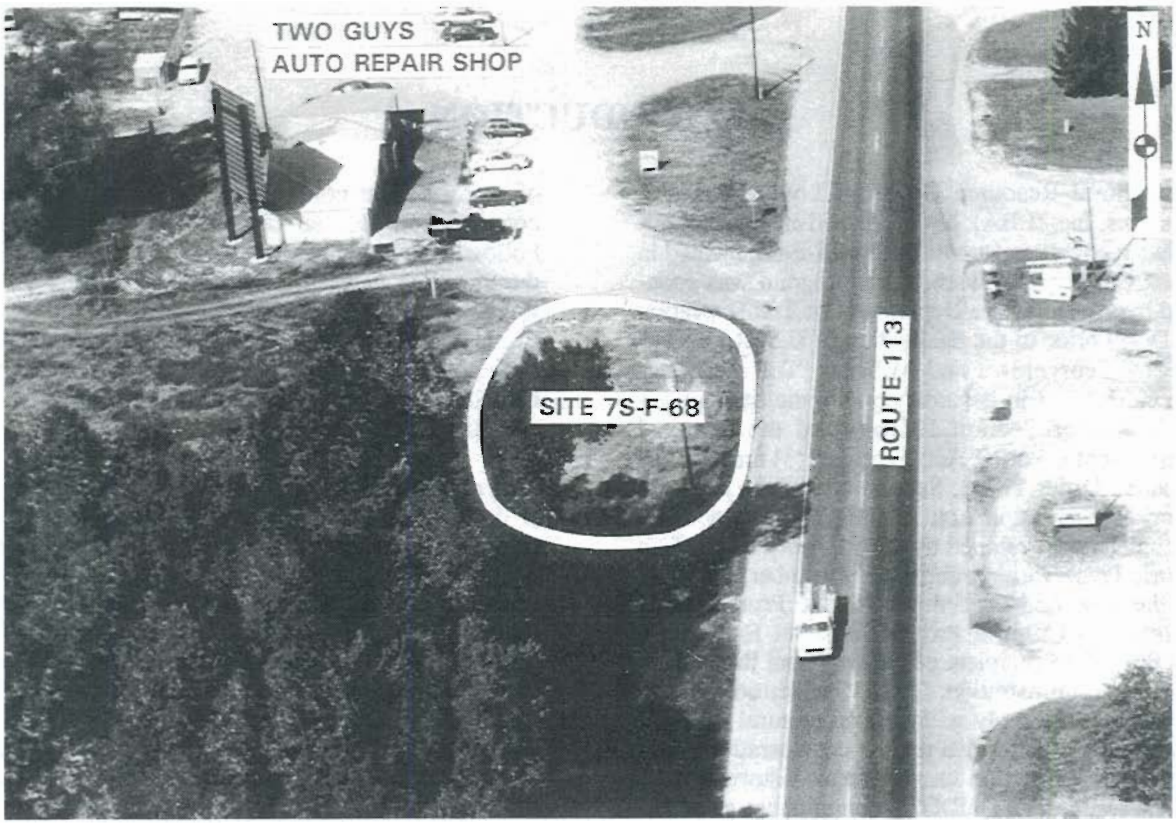


PLATE 2: Aerial View of Site Location.

with the Bureau of Archaeology and Historic Preservation, and the human remains were left in place. In November 1992, LBA was authorized to begin excavation of the historic burials. After excavation of the five previously known burials, topsoil and pavement were stripped from adjacent areas to identify additional interments. Four additional human burials and two dog burials were identified, and these features were excavated immediately after exposure. DelDOT authorized preparation of a separate report dealing with the cemetery at Site 7S-F-68 (DelDOT Series No. 134; LeeDecker et al. 1995).

The research findings from this study focus on issues of prehistoric chronology, subsistence, settlement patterns, intrasite patterning, environmental adaptation, and technology. The site-specific chronology indicates that the principal use of the site occurred during the Archaic and Woodland periods, but there is also evidence of Paleoindian use of the site. The initial period of frequent site use occurred during the Early Archaic period, followed by a period of infrequent use during the Middle Archaic. A second period of frequent use of the site occurred during the Late Archaic to Early Woodland periods, followed by sporadic visits during the Middle Woodland. Use of the site during the Late Woodland may have continued almost until the period of European contact.

The site occupies a low, sandy ridge surrounded by extensive swampland, and it appears to have been used on a seasonal basis for procurement of upland game and plant resources. Very little faunal material was preserved at the site, but flotation samples contained evidence indicating use of an important early cultigen--sumpweed or marsh elder *(Iva annua)*--as well as a few other economically important floral resources. A limited variety of features were present within the site, and only one formal cooking/heating area was identified. There were also a number of informal cooking/heating areas, as well as tools and activity areas apparently related to the plant food processing, tool maintenance, and other generalized processing tasks.

The site's prehistoric assemblage includes nearly 6,500 items, including pottery and lithic tools and debitage, all of which have been cataloged in a computer database. Lithic analysis focused primarily on issues of technology, function, style, and raw material selection and procurement. An extensive program of residue analysis was also undertaken. Located in the Mid-Peninsular Drainage Divide zone, the site and surrounding catchment area lacks a direct source for lithic raw material. Nonetheless, analysis indicated that the groups that visited Site 7S-F-68 made extensive use of cobble deposits that were scattered throughout the Delmarva Coastal Plain.

The archaeological collections from the site are currently in storage at LBA's archaeology laboratory in East Orange, New Jersey. The field records, original photographs, and other material related to the site have also been prepared for storage with the collection. The artifact collections and associated materials have been prepared for permanent storage at the Delaware State Museum.

II

BACKGROUND AND PREVIOUS RESEARCH

A. PREVIOUS ARCHAEOLOGICAL STUDIES

Site 7S-F-68 was initially identified during a 1988 survey of the Route 113 right-of-way between Georgetown and Milford (LeeDecker et al. 1989). The site occupies a small knoll or low ridge which is surrounded by extensive low-lying, poorly drained tracts (Figure 1). There is no nearby surface water, and a small wetland zone to the south corresponds to the headwater area of a small unnamed tributary stream.

During the Phase I fieldwork, two transects of two shovel tests each were excavated within the existing DelDOT right-of-way. The shovel tests were placed 15 meters apart and the transects were separated by 11 meters because of the small area within the right-of-way that appeared relatively undisturbed. One chert flake was recovered from the ground surface and five additional flakes were retrieved from two of the shovel tests. A range of lithic material was present, including jasper, ironstone, and quartz, in addition to chert.

Historic material was also recovered from all four Phase I shovel tests. This material included a delftware sherd, a square-cut nail, and amber bottle glass. Unidentifiable metal and flat glass were noted in two of the shovel tests but discarded in the field. Based on late nineteenth-century and early twentieth-century maps, the survey area was not defined as having potential for an historic occupation, and the initial survey did not identify any evidence of an historic structure or foundation associated with the site.

The 1991 Phase II evaluation consisted of site-specific historical research and more intensive archaeological examination, including the excavation of additional shovel tests and test units. A complete chain of title was prepared, and the 4 Phase I shovel tests were supplemented by 24 Phase II shovel tests and 12 test units. With one exception, the Phase II test units measured 1x2 meters in plan. The Phase II testing began with the extension of a grid over the site area, aligned with the highway right-of-way, and shovel tests were placed at 6-meter intervals according to a systematic unaligned pattern. The site occupies a low knoll that slopes down to a small wetland area, and it has been downcut on the east by the highway and on the north by a gravel and shell driveway leading to the automobile repair shop. The shovel testing suggested that the site area extends outside the right-of-way to the west, but the owner of the adjacent property would not permit archaeological testing on his land. Based on the Phase II testing, the site was estimated to cover an area measuring approximately 35 meters north-south, extending at least 20 meters west from the shoulder of Route 113 (Figure 2).

The Phase II excavations demonstrated that the soil stratigraphy was relatively straightforward, consisting of a plowzone (Ap-horizon) that overlay a weathered subsoil. The soils consisted primarily of fine sands, with some mottling and argillic development visible in the lowermost levels. In the most elevated area of the site, the A-horizon was severely truncated, while the downslope area exhibited a much more massive organic surface soil. The shovel testing indicated that the prehistoric materials were most concentrated in the more elevated portion of the site, with decreasing densities in the northern downslope area near the wetland. Prehistoric materials were recovered from depths of more than one meter.

Features identified during the Phase II fieldwork included a dog burial (Feature 1) and a charcoal concentration (Feature 2). The dog burial was located at the northern periphery of the site and within the gravel driveway area leading to the automobile repair shop. The deceased animal had been placed in a shallow rectangular shaft; aside from the skeleton, the burial pit fill was culturally sterile except for a quartz projectile point. It is believed that the dog burial is an historic or modern feature, notwithstanding the presence of a prehistoric projectile point. Feature 2 was a concentration of charcoal identified immediately beneath the plowzone. No artifacts were recovered from the feature during excavation; however, four liters of soil were retained for flotation processing. A 3.0-gm sample of charcoal from the feature yielded a radiocarbon date of 1140 $\pm$ 60 years BP (Beta-46395), which falls in the terminal Woodland I period. The feature probably represents a cooking area, although there was little associated fire-cracked rock that would suggest use as a dry roasting hearth. Aside from charcoal, the flotation samples did not contain any charred botanical material that would provide information regarding the site's prehistoric environment or the subsistence practices of the site occupants.

The Phase II artifact collection contains both prehistoric ceramics and lithics. A total of 27 prehistoric sherds were recovered, including both shell- and sand/grit-tempered wares. As a whole, the ceramics

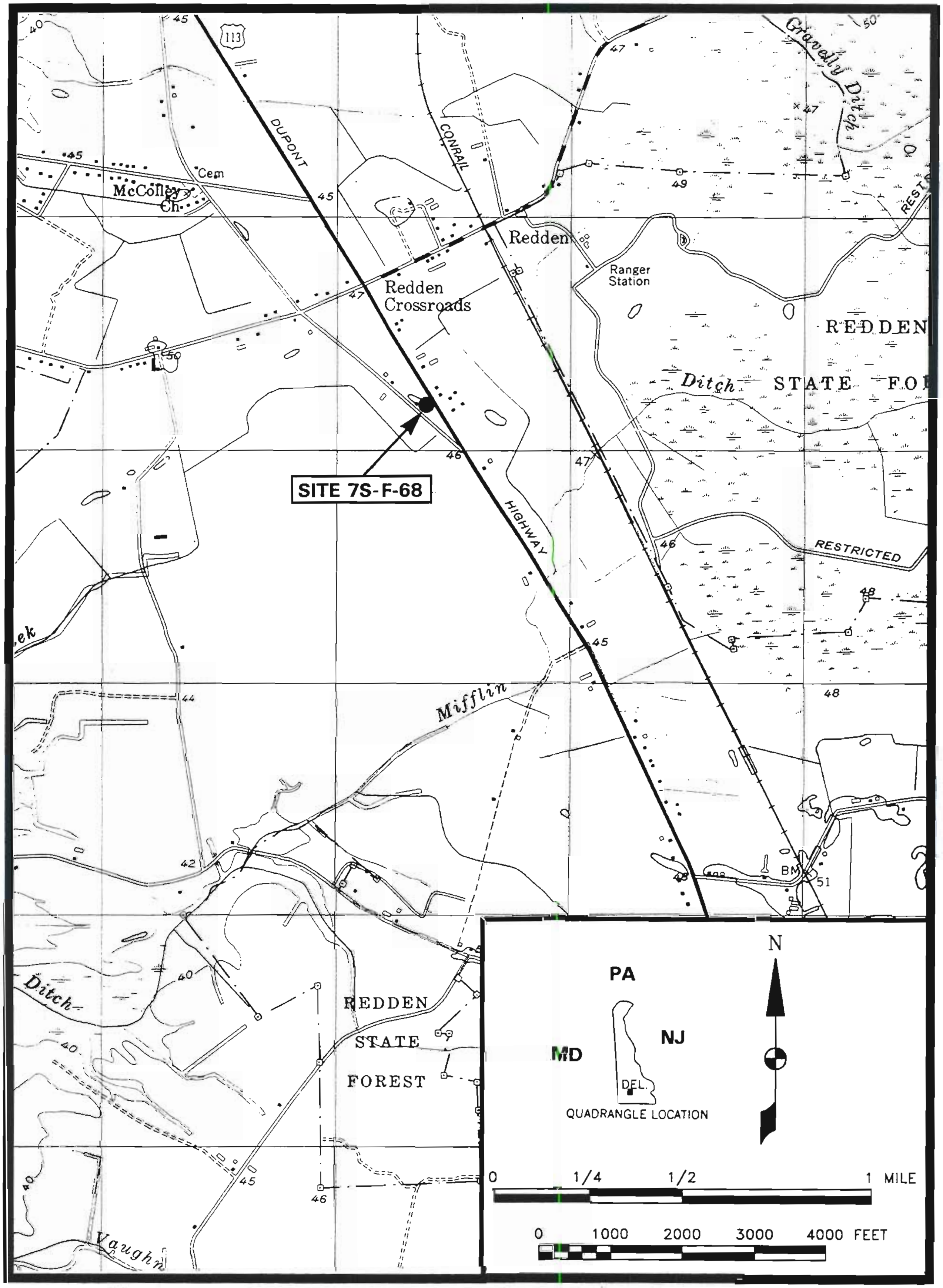


FIGURE 1: Site Location

SOURCE: USGS 7.5 Minute Quadrangle, Georgetown, Del., 1954 (Photorevised 1983)

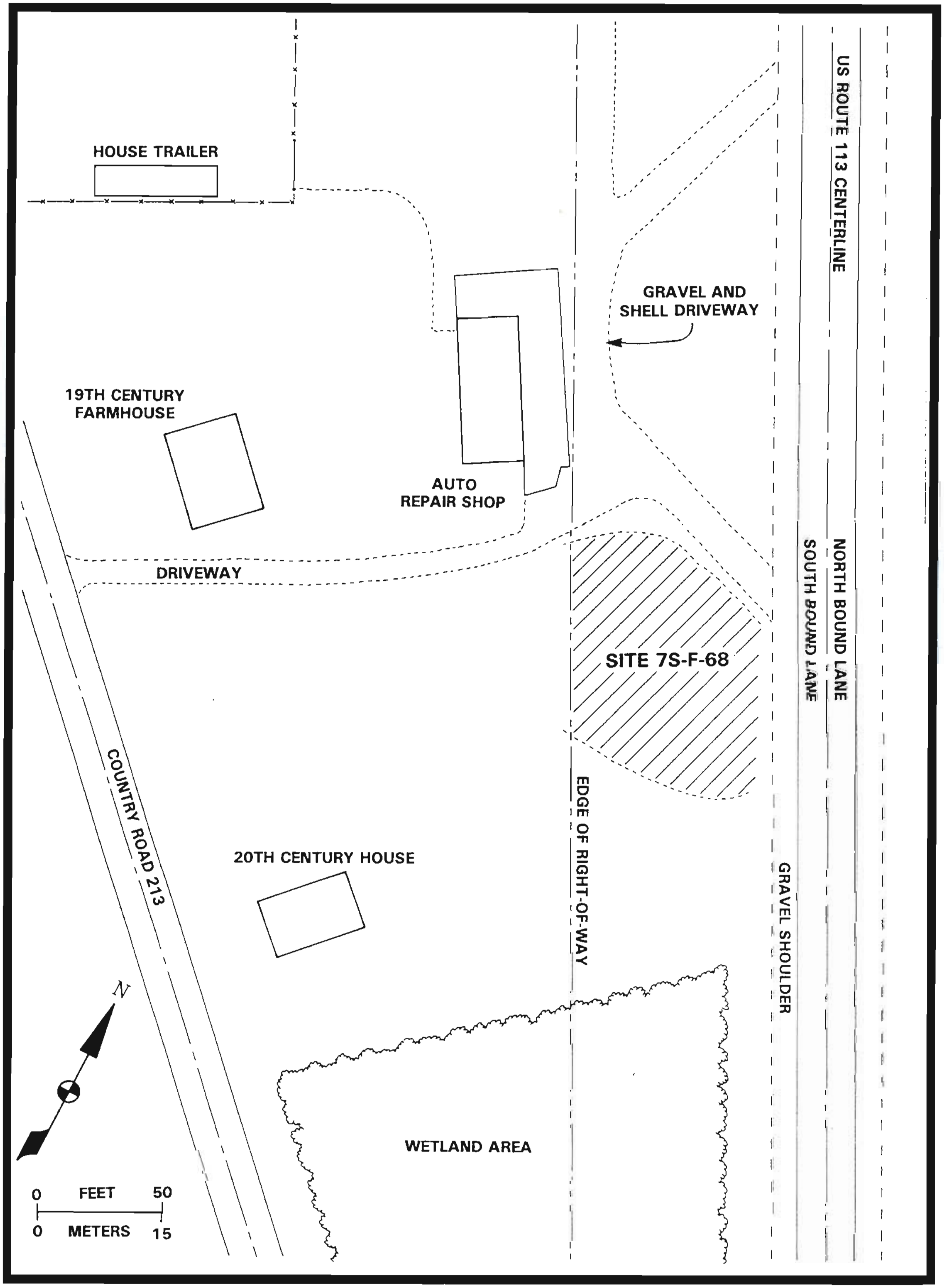


FIGURE 2: General Site Plan

were poorly preserved, and few of the sherds exhibited identifiable surface decoration. One rim sherd was identified in the collection, but none of the sherds was large enough to permit a determination of vessel form. The shell-tempered ceramics may all be placed within the Townsend series, indicating occupation of the site during the Woodland II period. The sand/grit-tempered ceramics were not identifiable as to specific ware group, and they are considered only a general Woodland period indicator.

The Phase II lithic assemblage contains a broad range of artifact types and raw materials. Although dominated by cryptocrystalline materials (jasper, chert, and chalcedony), the assemblage also contains appreciable amounts of quartz and quartzite, which are widely available in secondary cobble deposits throughout the Coastal Plain. Jasper, chert, and quartz account for the majority of the chipped-stone tools, but there are also some bifaces made of argillite, chalcedony, and rhyolite.

The bifacial implements include 13 projectile points, most of which are complete enough for typological identification. Two of the points resemble the St. Albans point type (Broyles 1971), which is an Early Archaic diagnostic. A third possible Early Archaic point is represented by a heavily beveled and resharpened quartz blade fragment. Late Archaic use of the site is indicated by the recovery of single examples of Otter Creek (Ritchie 1971), Halifax (Coe 1964), and Teardrop (Kraft and Blenk 1974) points. However, the chronology for the Archaic period is not well developed in Delaware, and it is possible that the Otter Creek and Teardrop points extend back into the Middle Archaic, while the Halifax point type may extend into the Woodland I period. Four points in the collection resemble the Rossville point type (Ritchie 1971), which appears in Delaware after circa 500 BC. One jasper Jack's Reef corner-notched point (Ritchie 1971) and an untyped stemmed point made of jasper also date to the Woodland I period. Other bifaces in the collection include 2 middle-stage bifaces and 4 unidentifiable fragments. The unifacial tools include 1 endscraper, 3 utilized flakes, and 1 retouched flake. These tools suggest a range of generalized processing or maintenance tasks. A single pitted cobble may be indicative of plant food processing activities. Lithic production tasks are well represented by cores and debitage. The majority of the cores exhibit bipolar production, a technique that permits maximum exploitation of available raw material. The various types of debitage in the collection indicate that the full range of the lithic reduction sequence was carried out at the site, from initial decortication and early reduction to bifacial thinning. Fire-cracked rock, indicative of cooking or heating activities, is represented primarily by quartzite, with minor occurrences of ironstone, quartz, siltstone, and sandstone.

The Phase II testing indicated that Site 7S-F-68 was used repeatedly during the Archaic and Woodland periods of prehistory. The site would be classified as a procurement site or microband base camp (Custer 1984), by reason of its environmental setting and small size. Archaeological criteria for identification of procurement sites and microband base camps are not well developed, but existing prehistoric settlement pattern models (Custer 1984) indicate that these site types are typically located on knolls or well-drained soils adjacent to wetland areas or low-order streams.

The recovery of a delftware sherd during the Phase I survey aroused interest in the site's historic component. During the Phase II fieldwork, a small amount of additional historic material was recovered, but analysis indicated that the historic deposits represented a combination of modern litter and sheet refuse associated with a farmhouse that faces Route 213, which is the old Georgetown-Milford Road. The title search indicates that the site area was historically associated with the farmhouse facing Route 213, and that structure is located roughly 150 feet from the site area (see Figure 2).

The site's Phase II historic assemblage is dominated by bottle glass, much of which is attributable to littering. Seven additional delftware sherds were recovered during the Phase II excavations, but otherwise the historic ceramic assemblage consists entirely of whiteware, ironstone and yellowware. The Mean Ceramic Date (South 1977) for the assemblage is 1850.2, which is markedly earlier than dates obtained for the other historic sites tested along U.S. Route 113. Without delft, the site's Mean Ceramic Date is 1897.5 and consistent with the other tested historic sites along Route 113. The presence of delft in the assemblage would be suggestive of a colonial occupation, but there is little else in the assemblage to support assignment of a seventeenth- or eighteenth-century date. Other than one heavily worn gunflint, no material that would suggest an early historic occupation was recovered. Another notable aspect of the historic assemblage is the presence of shell button wasters; similar deposits have been noted at several other sites along U.S. Route 113. Shell button manufacturing was one of Sussex County's important industries, and was carried out in both industrial and domestic settings. At Site 7S-F-68, this material was in a pavement context, and it was not considered archaeologically significant (LeeDecker et al. 1992).

B. REGIONAL PREHISTORY

Custer (1984, 1986a) has divided the prehistory of

Delaware into four periods: (1) the Paleoindian period (ca. 12,000 BC - 6500 BC), the Archaic period (ca. 6500 BC - 3000 BC), the Woodland I period (ca. 3000 BC - AD 1000), and the Woodland II period (AD 1000 - AD 1650). The European Contact period (ca. AD 1600 - 1750) marks the final years of Native American occupation of the area during early European colonization of the state. While Custer's chronology utilizes the traditional Paleoindian/Archaic/Woodland cultural stages, his bracket dates differ significantly from those used by most archaeologists in the surrounding region. Custer's chronology differs most significantly from the prevailing regional model in the truncation of the Archaic period. Most investigators bracket the Archaic period from roughly 8000 to 1000 BC, and divide the Archaic into Early, Middle and Late subperiods. Custer includes most of the Early Archaic period (circa 8000 - 6000 BC) in the Paleoindian period, and he subsumes the Late Archaic period (circa 3000 - 1000 BC) into the Woodland I period. Issues related to prehistoric chronology are discussed in more detail in Chapter IV.

The Paleoindian period marks the initial occupation of the state by small groups of nomadic Native American hunters and gatherers. Their presence coincided with the amelioration of late Pleistocene glacial environmental conditions throughout eastern North America and the beginning of early Holocene conditions: that is, cold temperatures and alternating periods of wet and dry conditions. The economic system of the Paleoindians was based largely upon the hunting of large, cold-adapted animals, including both migratory and nonmigratory species. Although direct evidence of Paleoindian use of nonmammalian food resources is lacking in the archaeological record of Delaware, paleoenvironmental data indicate that their exploitative territories included habitats in which plant foods and other edible resources were available. Palynological and geomorphological data suggest that the vegetation in Delaware during the Paleoindian period consisted of a mosaic comprised of deciduous and boreal forests and grasslands that would have provided graze, browse and shelter for a variety of small and large mammals. In conjunction with various surface water settings, these habitats would have been focal points for Paleoindian foragers.

Custer, following Gardner (1974 et seq.), views the Paleoindian settlement pattern as highly focused on sources of high-quality lithic material. Based on Gardner's work on the Flint Run complex, Custer defined a variety of Paleoindian site types: quarry sites, quarry reduction stations, base camps, base camp maintenance stations, outlying hunting sites, and isolated point finds. Custer discusses two alternative Paleoindian settlement pattern models that would reflect differential regional distribution patterns of lithic raw material. The cyclical model would be most applicable to settings that contain a single lithic source area, while the serial model would be applicable in territories that include a number of widely separated sources.

The stone tool kit of the Paleoindians was characterized by a limited number of bifacial and unifacial implements that suggest heavy emphasis on the procurement and processing of animal resources. These implements include projectile points, hafted and unhafted knives, scrapers, and less formalized flake tools. Of these, the fluted point is the diagnostic hallmark of the Paleoindian period. Other point styles indicative of the later part of this cultural period include both unfluted triangular forms and notched and stemmed points. The distributions and environmental settings of Paleoindian sites and isolated point finds suggest that these people maintained a way of life that consisted of relatively frequent movements of single or multiple family groups to and from resource-rich habitats. It appears that this basic subsistence/settlement strategy persisted with only minor variations for approximately 5,500 years.

Custer has identified a concentration of Paleoindian sites along the Mid-Peninsular Drainage Divide of the Delmarva Peninsula, a physiographic unit that encompasses the 7S-F-68 site area. Using modern LANDSAT imagery, it was found that Paleoindian site loci were strongly correlated with poorly drained or swampy areas. The Hughes complex in Kent County exemplifies this Paleoindian site distributional pattern. This complex includes a series of six surface finds located on low, well-drained knolls within or adjacent to a large freshwater swamp and other poorly drained areas (Custer 1986a:49-51).

The Archaic period is characterized by a series of changes in prehistoric Native American technologies, subsistence, and settlement. These shifts are interpreted as gradual human responses to the emergence of full Holocene environmental conditions. The landscape was dominated by mesic oak and hemlock forests. Reductions in open grasslands brought about by warm and wet conditions resulted in the extinction of certain cold-adapted grazing animal species (i.e., caribou and bison) that were the favored prey of Paleoindian groups. An alternative interpretation is that these vegetational changes were favorable to browsing animals such as deer which flourish in forest settings (Custer 1984, 1986a).

A rise in the sea level and an increase in precipitation at the beginning of the Holocene would have facilitated the development of inland swamps within the Mid-Peninsular Drainage Divide. At this time, Native American populations in these locales shifted from the more hunting-oriented foraging pattern of the Paleoindian period to one in which plant foods became a more important part of their economies. In southern Delaware, large swamp habitats such as Cedar Swamp and Burnt Swamp would have served as locations for the first large residential base camps, possibly occupied by several different family groups. Associated with these larger group camps are more numerous and smaller procurement sites situated in various settings that would have been favorable for hunting and gathering activities during different seasons of the year.

Based primarily on the work of Gardner (1978 et seq.), studies by Custer define three types of Archaic sites: macroband base camps, microband base camps, and procurement sites. The three site types are distinguished primarily by their environmental settings, the size of the occupant group, and the range of activities carried out at the site. Macroband base camps are located in settings that afford access to the greatest range and quantity of resources, and they exhibit evidence of occupation by relatively large groups that carry out a broad range of activities. Procurement sites represent the opposite end of the Archaic site type continuum. They exhibit evidence of occupation by small groups that carry out a limited range of activities, and they are located to afford access to a specific resource (Custer 1984, 1986a).

Archaic tool kits differ from those of the Paleoindian period in that they include a number of artifacts indicative of plant food processing (i.e., grinding implements and stone mortars). Although Archaic groups in Delaware appear to have been less mobile than the preceding Paleoindian populations, they were more mobile than later Woodland period groups. The sizes of Archaic exploitative groups seem to have fluctuated seasonally and with the availability of food resources.

Based upon palynological and geomorphological data from the Middle Atlantic region, the Woodland I period has been described as a time of "dramatic change in local climates and environments" in which "a pronounced warm and dry period" (i.e., a mid-postglacial xerothermic) began at approximately 3000 BC and persisted to approximately 1000 BC (Custer and Bachman 1984). During that period, the mesic oak and hemlock forests of the Archaic were replaced by more drought-resistant (xeric) oak and hickory forests and more abundant grasslands. Although these conditions effected the drying up of some interior streams, continued sea level rise resulted in the creation of highly productive and large brackish water marshes in coastal areas. In essence, the xerothermic is hypothesized to have effected shifts in the distributions of plant and animal species and the establishment of new resource-rich settings in some areas of the state.

In turn, these proposed shifts in climate, environmental conditions, and resource distributions are believed to have resulted in radical changes among resident prehistoric Native American populations in the study area, including a trend toward greater sedentism and more complex systems of social organization and interactions. For example, major river floodplains and estuarine swamp habitats became the primary resource zones and the locations of large residential base camps occupied on a multi-seasonal or year-round basis. Such sites are particularly prominent in northern Delaware; they include the Delaware Park Site, the Clyde Farm Site, the Crane Hook Site, and the Naamans Creek Site. Artifact assemblages and features from these sites suggest intensive utilization by prehistoric populations and a trend toward more sedentary lifeways. In southern Delaware, there was an increase in the utilization of shellfish in the coastal areas, concurrent with an inland shift in the locations of macroband base camps along the tidal drainages. Within the Mid-Peninsular Drainage Divide zone, there is little evidence that site distribution patterns changed from the preceding Archaic period (Custer 1984, 1986a).

Custer has observed that the Woodland I settlement pattern is characterized by a reduction in the number and variety of site locations utilized, although the three primary site types established during the Archaic period--macroband base camps, microband base camps, and procurement sites--continued into the Woodland period. However, Custer notes that Woodland period macroband base camps were significantly larger than Archaic macroband base camps, and there is some regional variation in the settlement patterns in various physiographic zones.

The tool kits of Woodland I groups are generally similar to those of the Archaic, with the addition of such items as heavy woodworking tools, soapstone and ceramic containers, broad-bladed points, and netsinkers. The increased abundance of plant processing tools over the preceding period suggests more intensive utilization of plant foods, which by the end of Woodland I times may have approached the level of productive intensification. The presence of non-local lithic materials such as argillite, rhyolite, and soapstone are interpreted as indicators of incipient regional trade and exchange networks. Soapstone and ceramic vessels are viewed as items that facilitated more efficient food preparation and storage of surplus foods. Pit features employed for food storage and the remains of prehistoric dwellings have been documented at the Delaware Park and Clyde Farm sites in northern Delaware.

The inferred reduction in overall group mobility, the presence of certain artifact types indicative of intensified resource processing, the possible generation of food surpluses, the presence of artifact caches, and the possible existence of increased interregional exchange networks as inferred from the presence of nonlocal lithic raw materials are interpreted as indicators of the initial development of ranked social organization as opposed to earlier egalitarian systems.

The Woodland II period within the Middle Atlantic region is marked primarily by the development of horticulture and increased sedentism. During this period, settlements became larger and more permanent and tended to be located adjacent to areas with easily worked floodplain soils. This period is also characterized by an attenuation in the interregional trade and exchange systems. The shift to agricultural food production effected important changes in the Woodland II settlement pattern, although the settlement pattern included the basic site types established during the Archaic period--macroband base camps, microband base camps, and procurement sites. Two Woodland II complexes have been defined for Delaware. In southern Delaware, the Slaughter Creek complex is characterized by the presence of Townsend ceramics, triangular projectile points, large macroband base camps and possibly fully sedentary villages with numerous food storage features. Most major sites assigned to the Slaughter Creek complex have been identified in the Delaware Shore, Mid-Drainage, and Coastal/Bay physiographic zones of southern Delaware. Current Slaughter Creek complex settlement models indicate that the Mid-Peninsular Drainage Divide Zone would have been used for special resource procurement sites (Custer 1984, 1986a).

The European Contact period is marked both by the initial contact between the Native American inhabitants of Delaware and European colonists and the subsequent total collapse of traditional native lifeways and socio-political organization. The picture is further complicated by the paucity of sites dating to this important period within the state. However, historical sources indicate that resident Native American populations had minimal interaction with European settlers and were subjugated by the Susquehannock Indians of southern Lancaster County, Pennsylvania. A small number of descendants of the original Native American inhabitants of Delaware still reside in the state today.

III

ENVIRONMENTAL SETTING

A. PHYSIOGRAPHY AND GEOLOGY

The site lies is within the Atlantic Coastal Plain Physiographic Province which is generally characterized by lowlying, nearly level topography. The Coastal Plain was formed by the deposition of material transported from beyond the Fall Line, and it is characterized by masses of unconsolidated sediments comprised of sands, gravels and clays of marine or fluvial origin. The site occupies a low knoll or ridge with a maximum elevation of approximately 50 feet above mean sea level (amsl). Surface elevations in the surrounding area lie at approximately 45 to 47 feet amsl.

Delaware may be divided into physiographic zones of similar geography and topography that are useful for discussion of prehistoric cultural manifestations (Custer 1986). Site 7S-F-68 falls within the Mid-Peninsular Drainage Divide physiographic zone which has been described as the "backbone" of the Delmarva Peninsula (Thomas 1966:3 in Custer 1986). This zone is defined by the Atlantic-Chesapeake watershed line that separates the headwaters of streams that flow toward the east and empty into the Delaware Bay and those that flow to the west through Maryland and empty into the Chesapeake Bay (Ireland and Matthews 1974).

In addition flat topography and slow-moving headwaters of the streams that empty into the Delaware and Chesapeake Bays, the Mid-Peninsular Drainage Divide zone is also characterized by swamps surrounded by sand ridges and by bay/basin features (Custer 1986). The site area is drained by headwaters and high-order tributaries of the Nanticoke River, which empties into the Chesapeake Bay. There is no visible stream channel within the wetland area immediately south of the site.

The surficial deposits in the site area have been identified as the Columbia Formation, a Pleistocene deposit consisting mostly of coarse-textured sediments that ranges in thickness from less than one foot to several feet. Landscapes associated with the Columbia Formation typically exhibit evidence of extensive reworking during the Holocene. The rise occupied by the site is most suggestive of a dunal landscape form, which is fairly common throughout southern Delaware. Often located at the margins of large swamp areas, these dunes exhibit varying sizes and complex curving forms (Wagner 1982).

B. SOILS

Site 7S-F-68 lies within the Pocomoke-Fallsington-Evesboro soils association, which is made up of soils that are poorly drained with a moderately permeable sandy loam or sandy clay subsoil and soils that are excessively drained with a rapidly permeable sandy subsoil. The site area occupies a small area of Evesboro loamy sand (loamy substratum, 2-5% slopes). Evesboro soils are typically coarse-textured and occupy upland settings, and they are characterized by excessive drainage (Ireland and Matthews 1974).

The pedological analysis undertaken for this study (Wagner 1992) included field examination of exposed profiles as well as laboratory analysis of particle size distributions and chemical properties. The particle size analysis strongly supported the dunal origin of the site's landscape setting, the profiles were dominated by fine and medium sands which are readily borne by wind.

Particle size distributions for Excavation Units 27 and 32 (Figure 3) demonstrate the range in soil composition with the site area. Unit 27, located in the more elevated area of the site with the highest density of prehistoric cultural material, is most representative of the site area. In that unit, particle size distribution is nearly constant with depth. Throughout most of the site, only very slight soil differences were apparent with depth.

The Unit 32 profile exhibits greater subsoil development as well as a finer-textured substratum, represented by the Cg horizon. The higher clay and silt content in the Unit 32 profile probably underlies the higher portion of the site area, and augering in the wetland area to the south the site identified a comparable subsoil within a half meter of the surface. This sandy clay loam substratum appears to have been the basal deposit upon which the eolian sands were deposited during the Pleistocene (Wagner 1992).

Sandy soils typically display weak soil development, and they are quite susceptible to vegetative denudation, reworking, and erosion. Natural processes such as animal burrowing and tree fall also contribute significantly to mixing and reworking in sandy soils. Despite the difficulties of interpreting weathering and horizonation in sandy soils, the particle size distribution in the Unit 27 profile suggests two sequences of

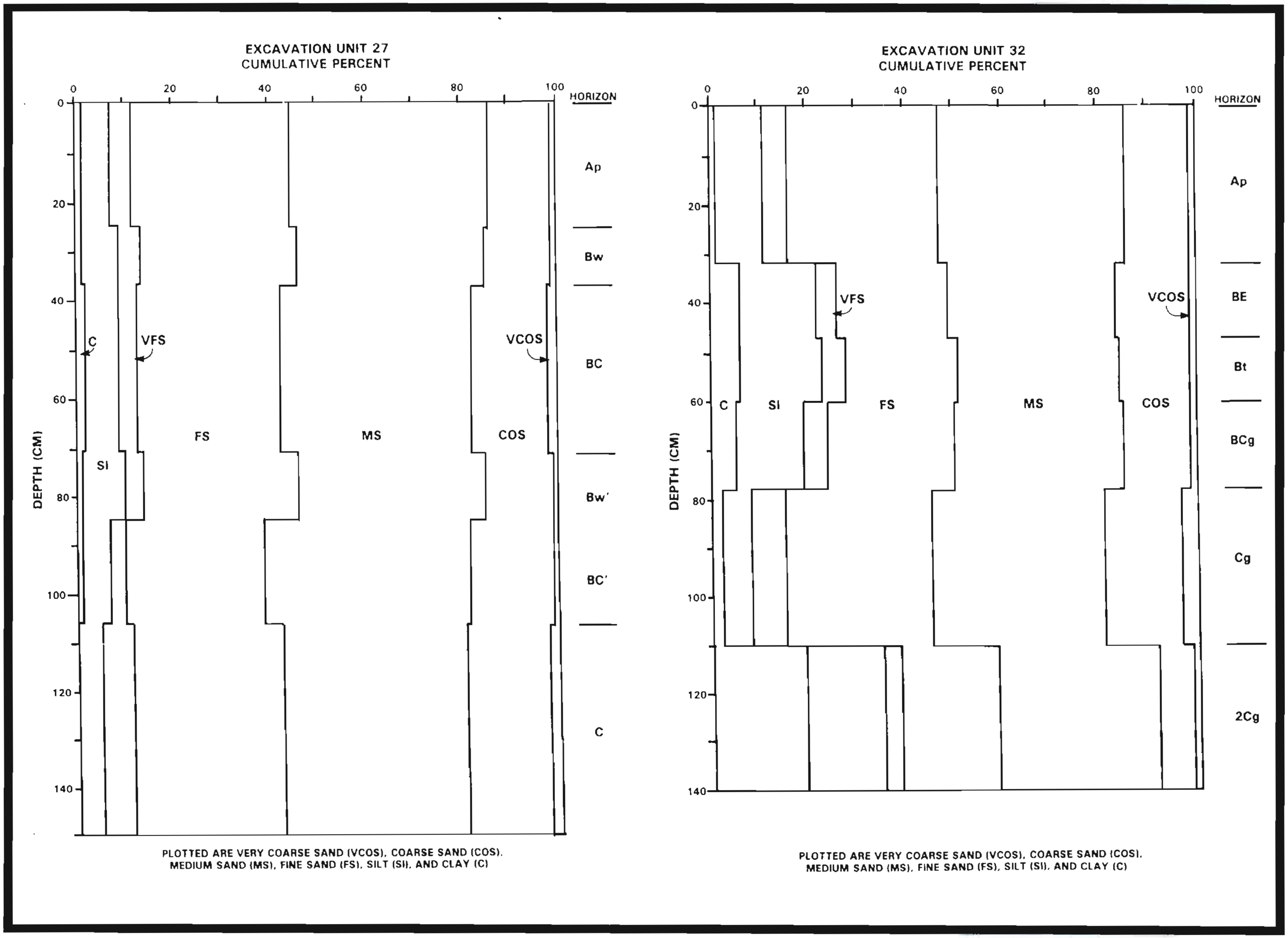


FIGURE 3: Soil Particle Size Distribution, Excavation Units 27 and 32

deposition and weathering. The two soil formation intervals are suggested by the two weathering intervals represented by the Bw-BC and Bw'-BC' horizons. The lower sequence (Bw'-BC') appears to represent an earlier interval of soil formation that was subsequently buried by a more recent deposition event. Given the difficulty of estimating the age of weathered substrata in sandy soils, it is suggested that periods of deposition could be correlated with dry periods. The lower horizon could then be correlated with the early Holocene, while the later soil formation episode could be correlated with a more recent xeric interval (Wagner 1992).

The bisequal profile seen in Unit 27 is not representative of the entire site. The more strongly developed soil of Unit 32 probably correlates with the lower sequence of Unit 27, and the lower, more poorly drained setting of Unit 32 would have afforded more landscape stability and more favorable conditions for vegetation during dry periods. Only a single weathering sequence was seen in the profiles of Units 48/35, located in an elevated area of the site. The single weathering sequence in this unit probably correlates with the upper, more recent sequence in Unit 27 (Wagner 1992).

The soil chemical tests for the site are typical of Coastal Plain soils (Table 1). The soils are strongly acidic, but despite the presence of a plowzone, there is little for the application of chemical fertilizers. Unit 27 did exhibit high to very high concentrations of phosphorous, and this may be associated with the prehistoric occupation of the site. Application of fertilizer during the historic period could account for the elevated phosphorous content, but there is no evidence of any associated chemical fertilizer residues. Phosphorous does not readily move within a soil profile, and elevated phosphorous levels are commonly associated with prehistoric occupation sites (Wagner 1992).

C. PALEOENVIRONMENT

Given the widespread evidence of human occupation of the Middle Atlantic Coastal Plain beginning as early as the Late Pleistocene, a reconstruction of the regional environmental history should consider at least the last 11,000 years. The primary factors to be considered in a local paleoenvironmental reconstruction are changing climatic conditions and sea levels which, in turn, influenced the local distribution of floral and faunal resources. Analysis of fossil pollens has provided the most direct method for inferring past environmental conditions. Paleoclimatic conditions can be inferred from fossil pollen evidence because of the ecological relationship that exists between biotic communities and their environment. The analysis of fossil pollen is used to determine the composition of past vegetational communities, and using the knowledge of the present relation of climatic variables such as temperature and moisture to certain plant species and genera, past climatic conditions are inferred. The concept of plant succession is the principal technique for determining past changes in vegetation and, by inference, climate (Ogden 1965:488).

During the Pleistocene epoch, a series of massive continental glaciers advanced and retreated over much of North America. Because vast amounts of water were incorporated into these ice sheets, the sea levels were 300 to 500 feet lower than at present. The late Pleistocene was not only slightly cooler than the present, but was also characterized by higher levels of precipitation (Carbone 1976). The generally accepted marker for the end of the Pleistocene is the beginning of the glacial retreat immediately following the Valders substage maximum, which has been dated ra

Table 1: Results of Soil Chemistry Analysis

UNIT	DEPTH	Org.%	P	K	Mg	Ca	pH
27	0-25 cm	0.8	62	16	8	50	5.0
27	25-37 cm	0.5	61	12	7	30	5.0
27	37-71 cm	0.2	53	11	5	30	4.9
27	71-85 cm	0.1	51	16	12	50	5.2
27	85-106 cm	0.1	26	13	15	70	5.4
27	106-153 cm	>0.1	50	9	9	60	5.7
32	0-32 cm	1.4	36	40	15	50	4.9
32	32-47 cm	0.8	15	35	6	20	4.8
32	47-60 cm	0.2	8	30	11	20	4.8
32	60-78 cm	0.1	7	26	12	30	4.8
32	78-110 cm	>0.1	28	12	10	50	4.9
32	110-122 cm	0.3	11	32	38	110	4.8

Chemical Tests: Org. % -- percent of organic matter; P -- available phosphorous; K -- potassium: Mg -- magnesium; Ca -- calcium; pH -- soil acidity.

diometrically to about 10,500 years BP.

The clustering of a large world-wide sample of radiocarbon dates indicated that an abrupt climatic shift occurred over a period of a few decades, marking the beginning of the present Holocene epoch (Bryson et al. 1970). As the sea levels rose with the release of the glacial meltwater, the ancestral Susquehanna River Valley and the Delaware River Valley were drowned, and the rising water eventually formed the estuarine environments of the Chesapeake Bay and the Delaware.

While data indicate that the sea level has been rising continuously during the past 12,000 to 14,000 years, the rate of marine transgression over the Coastal Plain has varied considerably. In the millenia immediately following the glacial maxima, sea levels rose relatively rapidly, while in the most recent millenia, sea levels have been rising at a rate of somewhat less than one foot per century (Edwards and Merrill 1977).

Amelioration of the glacial climatic conditions that characterized the Pleistocene epoch led to the establishment of modern environmental conditions. The first pollen studies in North America defined a sequence of five climatic episodes, differentiated according to relative temperature and moisture. This climatic sequence from post-glacial to modern times included five relatively distinct periods: (1) a moist, cool post-glacial period represented by a maximum of spruce and fir; (2) a dry, warmer period represented by a maximum of pine; (3) a more humid and warm period represented by beech and mixed deciduous elements such as oak and hemlock; (4) a warm, dry period represented by a maximum of oak and hickory; and (5) the modern period, more moist and cool than the preceding period, represented by a mixed deciduous composition dominated by oak and chestnut (Deevey 1943; Sears 1942).

The biogeographical patterns of the Middle Atlantic Coastal Plain for the late Pleistocene have not yet been definitively reconstructed. Detailed paleoenvironmental syntheses have been completed for the Shenandoah Valley (Carbone 1976) and the Upper Delaware Valley (Dent 1979). These studies are useful for understanding regional paleoenvironmental conditions, however, a reconstruction of local conditions should also consider applicable pollen cores. For Delaware, Custer (1984, 1986) relies heavily on Carbone's (1976) work and discusses paleoclimatic history in terms of an episodic model wherein abrupt, rather than gradual, changes in climate influenced the regional biogeography.

There are no available pollen profiles that would be wholly suitable for reconstruction of the environmental history of the 7S-F-68 site area. The environmental character of the site area vicinity must be inferred from a consideration of regional conditions such as overall trends in climate together with the local variations in altitude, lithology, soils, solar exposure, and drainage. Dent (1985) has demonstrated that many distinct plant communities may exist within a geographically restricted area, depending on variations in altitude, exposure to sunlight, and availability of water.

Custer's (1984, 1986) discussion of the Lower Coastal Plain paleoenvironmental sequence would be generally applicable to the site area, as there is scant information to treat separately the Mid-Peninsular Drainage Divide physiographic zone. Pollen samples were recovered from the Dill Farm site, located in southern Kent County, and these would pertain directly to the Mid-Peninsular Drainage Divide zone; however, the Dill Farm sequence does not fully represent the Late Glacial and Holocene, so that it is of somewhat limited value. A summary of the regional paleoenvironmental history, based on Custer's (1984, 1986) statewide synthesis, is presented in Table 2.

For more than 15 years, Carbone's (1976) research in the Shenandoah Valley has been the principal source of paleoenvironmental data for archaeologists working in the Middle Atlantic region. However, a recently-extracted pollen core from an abandoned stream channel near the Indian Creek Site (18PR94) in Prince Georges County, Maryland has provided important new information for reconstruction of regional prehistoric environments in the Middle Atlantic Coastal Plain (LeeDecker et al. 1991). The DB-6 pollen core from Indian Creek contains a virtually complete record of the local vegetational succession from the Late Glacial to the historic period. Seven pollen zones were defined in the DB-6 core, based on pollen percentages and influxes of individual species, and the chronology of the pollen zones was accomplished by a suite of radiocarbon dates and calculation of sedimentation rates between dated horizons (Brush 1990).

During the Late Glacial period, the climatic patterns in the region were controlled to a large extent by the presence of the Laurentide ice sheet. The ice sheet would have prevented incursions of northern Arctic air in the lower continental region, thereby allowing somewhat warmer winter temperatures in the midcontinental area. Strong Pacific westerly winds would have prevailed, and the proximity of the maritime tropical air mass to the edge of the ice sheet would have created a zone of intense frontal activity in the northern unglaciated portions of the Middle Atlantic region.

Available pollen evidence indicates that the dominant forest elements were spruce and pine and that nonar

TABLE 2: PALEOENVIRONMENTAL EPISODES, DELAWARE LOWER COASTAL PLAIN

EPISODE	DATES	GENERAL CHARACTERISTICS
Late Glacial	10,000-8,000 B.C.	Mosaic of different vegetational communities; open grasslands within coniferous forests; deciduous elements present in wetland areas, etc.; bay/basin features open and active; animals include cold-adapted megafauna (musk ox, mammoth, mastodon), peccaries, white-tailed deer, caribou, elk, beaver, etc.
Pre-Boreal/ Boreal	8,000-6,500 B.C.	Reduction of open grasslands and spread of forests dominated by pine and northern hardwoods; extinction of Pleistocene megafauna and reduction of habitat for grazing and browsing species
Atlantic	6,500-3,100 B.C.	Full appearance of modern environment with warm, moist conditions; continental climate with marked seasonal differences; widespread dominance of mesic oak-hemlock forests; modern faunal communities
Sub-Boreal	3,100-800 B.C.	Warm, dry climate (mid-postglacial xerothermic) at the beginning of the episode, followed by gradually increasing moisture and cooling temperatures; spread of grasslands and reduction of oak-dominated forests
Sub-Atlantic	800 B.C.-recent	Cooling reduced the moisture stress of the Sub-Boreal, leading to essentially modern conditions; upland forests include a mix of coniferous and deciduous species; reduction of sea level rise permits florescence of estuarine environments in coastal areas

Source: Custer (1984, 1986)

boreal flora, such as grasses, shrubs, and herbs, were also present. This may be indicative of a mosaic of vegetational habitats, including open grasslands, coniferous forests, and deciduous floodplain forests. The Full Glacial and Late Glacial fauna would have included a variety of extinct and currently existing animals. Some of the larger animals that would have been present include browsing mastodon, mammoth, horse, camel, caribou and white-tailed deer, while the smaller animals would have included wolf, skunk, otter, weasel, fox, moles, shrews, squirrels, lemmings, and mice (Carbone 1976; Custer 1984).

The Late Glacial vegetation in the Indian Creek vicinity, represented by Zone 1 in the DB-6 core, was dominated by pine and spruce, with alder becoming more abundant toward the end of the period. Among the nonarboreal plants, madder, milkwort, and composites were dominant. Cool, floodplain conditions are clearly indicated by the pollen record.

A rapid shift in the climatic patterns that occurred circa 10,500 BP marked the onset of the Preboreal/Boreal episodes. This was marked by an increase in the duration of southern air masses, an increase in temperatures, and an increase in available sunshine brought about by a reduction in cloudiness. By 8000 years BP, the glacial ice mass was still large enough to influence air circulation patterns, and strong westerly winds still prevailed. Regional vegetation patterns were characterized by the reduction and eventual closure of open grassy habitats and the replacement of spruce by pine or deciduous species. The establishment of northern hardwood forests occurred in the Coastal Plain during the Preboreal episode. The increased temperatures and reduction of grassland led to a northern retreat of animals adapted to grassland and forest-edge habitats, and this Preboreal/Boreal episode as a whole was characterized by a reduction in biological carrying capacity. The disappearance of the Late Glacial vegetational mosaic may have heightened the importance of wetland areas to animals such as deer, elk, and moose (Carbone 1976; Custer 1984).

The Preboreal/Boreal episode is represented by Zone 2 in the DB-6 core. Zone 2 is marked by a major increase of birch and a decrease of pine and spruce, while alder decreases somewhat but remains plentiful. Oak increases in this zone but remains less plentiful than birch. Goldenrod and arrowwood are abundant among the non-arboreal taxa. Warming conditions are indicated by the increase of oak, and the abundance of goldenrod may be indicative of open areas within the local landscape.

A sharp reduction in the duration of Arctic air masses occurred during the Atlantic episode, allowing a continuous warming trend that was accompanied by an increase in precipitation. Regional vegetation patterns were characterized by an initial expansion of hemlock and later of oak. The warm, wet conditions of this episode may have fostered the expansion of wetland areas. Modern fauna were established during this episode, and the principal animals of importance to human populations were turkey and deer (Carbone 1976; Custer 1984).

Warming conditions are indicated by the pollen composition of Zone 3 in the DB-6 core, dated circa 5700-3000 BC, and this zone also indicates much more moist conditions. The reduction of pine and birch and the disappearance of spruce and fir occur in this zone. Oak, hazelnut, and alder are the dominant arboreal species, and maple, black gum, beech, ash, and walnut are also present. Cinnamon-fern is the dominant herbaceous species, and sedges reach their peak in this zone. The warm, moist conditions indicated by Zone 3 appear to correspond with the early part of the Atlantic climatic episode; however, the onset of the Atlantic episode is believed to have occurred circa 6500 BC (Carbone 1976; Custer 1984), somewhat earlier than the onset of Zone 3 conditions at Indian Creek.

The postglacial warming trend culminated during the Subboreal episode. Regionally, the xerothermic conditions led to an expansion of grasslands and the dominance of an oak-hickory forest type. Squirrel and turkey populations would have benefited from the dominance of nut-bearing trees, while species intolerant of dry habitats would have declined. Amelioration of the xerothermic conditions at the close of the Subboreal permitted the establishment of modern forest conditions. The reduction in the rate of sea level rise that occurred during the Subboreal permitted the establishment of stable estuarine environments in the tidal areas of the Coastal Plain.

With the formation of tidal wetland marshes adjacent to the Chesapeake Bay and the Delaware Bay, the Delmarva peninsula reached its peak carrying capacity, replete with waterfowl, shellfish, and marine fish (Carbone 1976; Custer 1984; Wesler 1985). Essentially modern environmental conditions continued through the Sub-Atlantic episode, with minor climatic fluctuations.

The drier, mesic conditions of Zone 4 in the DB-6 core probably correspond to the mid-postglacial xerothermic conditions during the Subboreal climatic episode. In Zone 4, oak continues as the dominant arboreal species, and cinnamon-fern reaches its peak. Pine, hickory, and walnut increase in this zone, while alder, birch, and hazelnut decrease. In addition to cinnamon-fern, abundant non-arboreal taxa include blueberry and elderberry, while arrowwood and buckwheat are present in moderate frequencies.

Zone 5 in the DB-6 core indicates that significant change in the local environment occurred after circa 2000 BC (3860 BP). Zone 5 is marked by a major reduction of arboreal pollen and an expansion of herbaceous species. Oak accounts for the majority of the arboreal pollen, but in significantly decreased frequencies. Major influxes of the bean family and elderberry, together with moderate increases in blueberry and arrowwood, mark Zone 5, which lasted until circa AD 200.

At the regional scale, Sub-Atlantic climatic conditions, characterized by the return of cooler, more moist conditions, led to the reestablishment of mixed deciduous forests, beginning circa 800 BC. However, non-arboreal species continued to dominate the local environment in the Indian Creek vicinity until the historic period. Arboreal pollen remained at low levels in Zone 6, and many of the herbaceous taxa also disappeared. Ericaceae (blueberry spp.) increased during this interval, possibly indicating the presence of heaths adapted to cool conditions. Cattail, which is present exclusively in Zone 6, is also represented in moderate numbers. At Indian Creek, the Zone 6 conditions persisted until the European contact.

D. FLORA AND FAUNA

Essentially modern environmental conditions were reached approximately 1000 years before the present, that is during the Sub-Atlantic episode. Some minor fluctuations have occurred since that time, but it is generally recognized that modern distribution of flora and fauna closely approximates that of the past thousand years. Of course, one must recognize the profound environmental changes that have occurred as a result of cultural modification of the landscape.

At the time of the initial European contact, the vegetative cover in the Middle Atlantic Coastal Plain was primarily a deciduous forest. This hardwood forest and its associated vegetation would have provided a fairly abundant supply of nuts, fruits, bulbs, and leaves. The terrestrial animals that inhabited the region included white-tailed deer, black bear, porcupine, squirrel, chipmunk, woodchuck, turtle, weasel, skunk, fox, wolf, cougar, raccoon, opossum, muskrat, otter, mink, beaver, turkey, shrew, rabbit and bobcat (Turner 1976, 1978).

Oak would have been the dominant deciduous element in the forests surrounding 7S-F-68 site vicinity, with an admixture of loblolly pine, Virginia pine and other deciduous species. Poorly drained wetland areas would have included pin oak, willow oak, red maple, sweetgum, blackgum, holly, sweetbay, dogwood, beech, birch, red cedar and cypress (Custer 1984, 1986; Ireland 1974).

E. SITE CATCHMENT ANALYSIS

Thomas et al. (1975) conducted a survey of environmental resources available in the Delaware Coastal Plain, and the results of that study may be used to evaluate the resource potential of the catchment area surrounding the site. In Sussex County, much of the Mid-Peninsular Drainage Divide area had an oak-gum-maple-cypress climax forest associated with flat upland topography, which was classified as a poorly drained swamp zone by Thomas et al.. Although the site area occupies slightly elevated knoll or dunal landform within this zone, the surrounding catchment area is overwhelmingly dominated by upland wetland areas.

The Redden State Forest and the Ellendale State Forest, located along Rt. 113 to the north of the site, contain extensive areas of upland wetlands. The understory vegetation of these poorly drained to swampy woodland areas is very dense, a feature that affords excellent cover for wildlife such as turtles, snakes, ducks, deer, bear, squirrel, rabbit, mink, otter, muskrat, turkey and beaver. Deer and other browse-oriented species find this habitat especially attractive (Thomas et al. 1975). Numerous floral resources are available in wetland areas, providing a wide variety of seeds, roots, tubers, and leafy greens of known ethnographic use for food, medicine, and other uses.

TABLE 3: SUMMARY OF FAUNAL AND FLORAL RESOURCE AVAILABILITY IN SITE CATCHMENT AREA

RESOURCE	AVAILABILITY
Faunal Resources	
Eastern cottontail	high
Gray squirrel	high
White-tailed deer	high
Beaver	high
Wild turkey	medium to high
Muskrat	low
Geese and ducks	low
Otter, mink, and weasel	low
Anadromous fish	low
Shellfish	low
Floral Resources	
Greens	high
Roots	high
Fruits	high
Seeds	medium to high
Nuts	medium

Some important resources known to have been important in aboriginal subsistence would have been virtually absent from the site catchment area, particularly waterfowl, shellfish, and anadromous fish (Table 3). These resources would have been seasonally abundant in other areas of the Delmarva Coastal Plain. Waterfowl, which are abundant during migratory seasons, prefer open marshy habitats, which are found in the tidal areas in the coastal zone. Resources such as shellfish and anadromous fish would have been most abundant in the riverine and estuarine areas in the coastal and mid-drainage zones. Located on a drainage divide, the site catchment area lacks significant water courses that would have provided the optimum habitat for fauna such as mink, otter, and weasel.

A site catchment analysis was undertaken, based on a technique developed by Roper (1979). Using soils information as a basis for classification of the environment, the area surrounding Site 7S-F-68 was broken into three major groups (1) well-drained, (2) moderately well drained, and (3) poorly drained. These soil groups would respectively correlate with the Well-Drained Woodlands, Transitional, and Poorly Drained Woods and Swamp micro-environments defined by Thomas et al. (1975). The acreage occupied by each soil category was computed in three zones surrounding the site, which were successively defined within a one-mile, two-mile or three-mile radius of the site (Table 4).

The results show that the general area surrounding the site is dominated by poorly drained soils, which is perhaps typical of the Pocomoke-Fallsington-Evesboro soils association which occupies much of Sussex County (Ireland and Matthews 1974). Among the three catchment areas considered, the smallest (acreage within a one-mile radius of the site) exhibits the highest proportion of poorly drained acreage, which suggests that the site location was selected for maximum access to resources in this poorly drained (i.e., swamp) areas. As one moves away from the site, the relative proportion of swampy acreage decreases, as shown by the amounts of poorly drained soils in the 1-2-mile and 2-3-mile catchment zones.

The site itself occupies a well-drained setting afforded by a narrow dune-like formation that projects into a large swamp. Figure 4 illustrates the distribution of well-drained, moderately well-drained, and poorly drained soils within the 1-mile catchment area surrounding the site.

TABLE 4: SITE CATCHMENT ANALYSIS BY SOIL DRAINAGE

CATCHMENT AREA	SOIL CLASSIFICATION WELL-DRAINED (ACRES/%)	MODERATELY DRAINED (ACRES/%)	POORLY DRAINED (ACRES/%)	TOTAL (ACRES/%)
< 1 MILE RADIUS	124 ac 6.2%	741 ac 7.0%	1,746 ac 86.8%	2,011 ac 100%
1-2 MILE RADIUS	947 ac 15.7%	470 ac 7.8%	4,614 ac 76.5%	6,031 ac 100%
2-3 MILE RADIUS	4,379 ac 24.2%	1,212 ac 6.7%	12,505 ac 69.1%	18,096 ac 100%

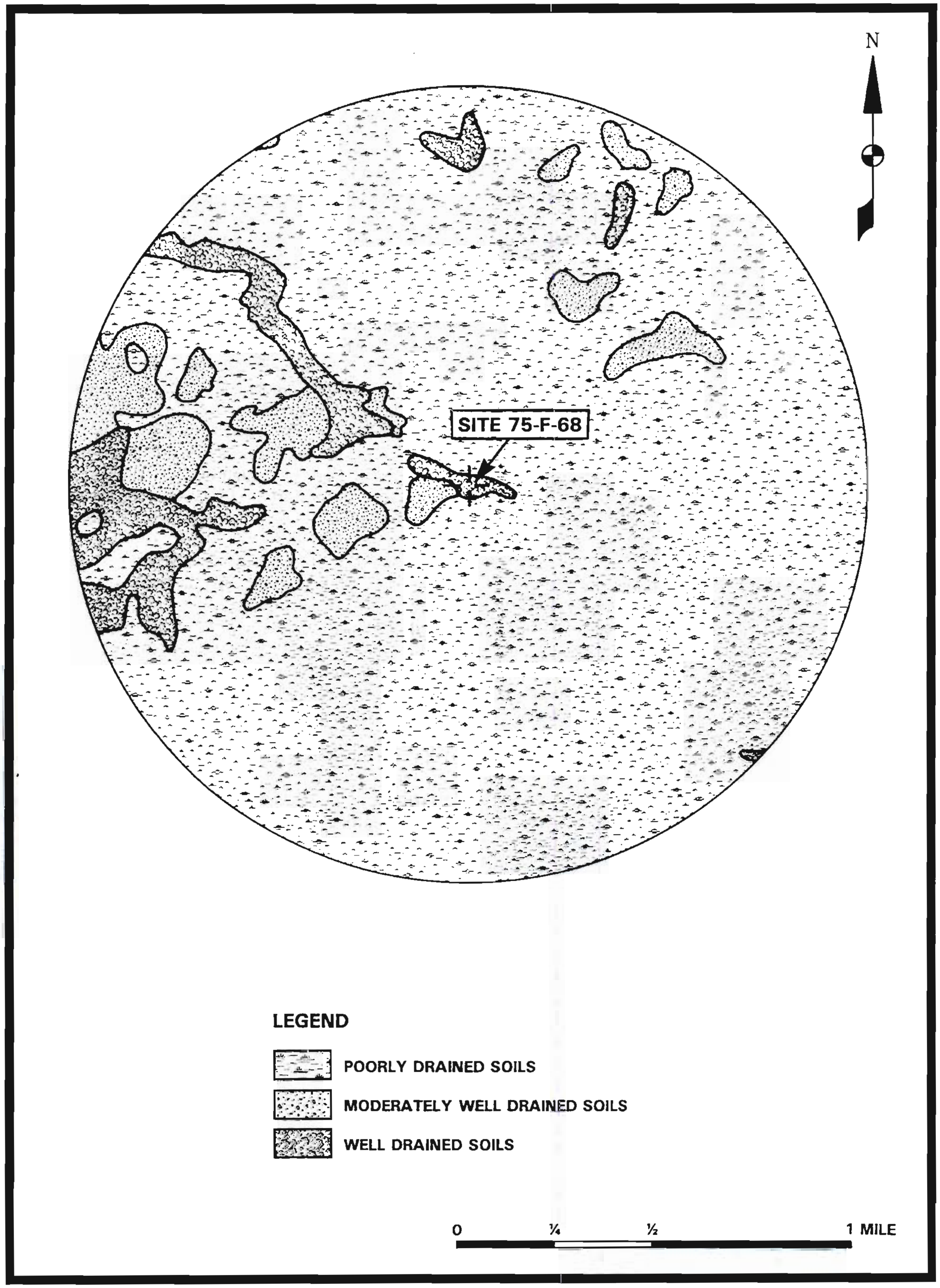


FIGURE 4: Site Catchment Area

IV

RESEARCH DESIGN

A. INTRODUCTION

This chapter presents a discussion of the research design that was developed to guide the data gathering, analysis, and interpretative efforts of the study. The research design was structured to address several information needs, or themes, that are widely used in prehistoric archaeology. These themes include chronology, subsistence, settlement patterns, intrasite patterning, technology, and environmental adaptation. In addition to these issues of general interest in regional prehistory, the research design must also focus on questions of a more site-specific nature such as local geomorphology and site formation processes.

B. PROBLEM ORIENTATION AND RESEARCH CONTEXT

1. *Chronology*

The chronology theme pertains to the basic temporal units of prehistory. The Phase I and II investigations provided evidence that the site was used or occupied repeatedly during the Archaic and Woodland periods, roughly bracketing the period from circa 6500 BC to AD 1650. It was expected that the data recovery program would provide a much larger sample of culturally diagnostic artifacts and hence enable construction of a site-specific chronology that could be compared to the regional chronological sequence.

Any discussion of prehistoric chronology must address the various chronological schemes advanced by different archaeologists working in Delaware, the Middle Atlantic region, and the broader Eastern Woodlands culture area. Custer (1984, 1986a) has divided the prehistory of Delaware into four periods: (1) the Paleoindian period (ca. 12,000 BC - 6500 BC), the Archaic period (ca. 6500 BC - 3000 BC), the Woodland I period (ca. 3000 BC - AD 1000), and the Woodland II period (AD 1000 - AD 1650). The Paleoindian, Archaic, and Woodland periods or developmental stages are widely used throughout the Middle Atlantic and Eastern Woodland regions.

Custer, following Gardner (1974), extends the Paleoindian period to include the corner-notched and side-notched phases represented by Palmer and Kirk points, and argues for a 6500 BC terminal date for the Paleoindian period. Most archaeologists outside the Middle Atlantic region consider Clovis points and closely related forms (e.g., Dalton points) as the principal diagnostic artifacts of the Paleoindian period, and use a terminal date of approximately 8000 BC for the beginning of the Archaic period.

Archaeologists in the region have traditionally divided the Archaic into Early, Middle, and Late subperiods, but there is much disagreement regarding bracket dates for the Early and Middle subperiods. The initial use of Site 7S-F-68 is represented by Palmer and Kirk points, which were made during the period circa 7800-6000 BC, an interval that corresponds roughly to the Early Archaic subperiod. The site assemblage also includes a group of bifurcate-based points, which were made between 7000 and 5300 BC. Many archaeologists include the bifurcate-based points in the Early Archaic period, although Gardner (1987) and his students (e.g., Stewart 1990) consider the bifurcate-based points as Middle Archaic artifacts. Others place the bifurcate phase in the Early Archaic, as is more commonly done in the Southeast, and bracket the Middle Archaic to the interval from circa 6000 BC to 4000 BC. In Delaware, Custer (1984, 1986a) places the bifurcate-based points at the beginning of the Archaic, abandoning the traditional use of the Early, Middle, and Late subperiods, and subsuming what most archaeologists consider Late Archaic into his Woodland I period.

Basic information regarding the prehistoric cultural sequence in the Delmarva Peninsula area is scant, particularly for the Archaic period. Basic questions of chronology need to be resolved by obtaining additional radiocarbon dates and from stratigraphic excavations, and questions of subsistence and settlement pattern must be based on intensive site excavations.

As traditionally defined, the Archaic period represents the longest chronological unit of human occupation in the eastern United States, but very little is known about cultural development during the several millenia that followed the end of the most recent ice age. Caldwell's (1958) primary forest efficiency model posits a period of increasing familiarity with the environment which allowed more efficient exploitation of seasonally abundant food resources and which ultimately permitted an increase in population and greater social complexity. Following this model, the Archaic has been viewed traditionally as a period of gradual, steady population increase.

The various Archaic period chronologies have led to a degree of confusion that prevents critical examination of the model of steady population increase during the Archaic. The results of excavation at the Indian Creek Site, an Archaic gathering camp in Prince Georges County, Maryland, indicate that an interval of depopulation occurred during the 5000-4000 BC period (LeeDecker et al. 1991). The interval of site abandonment at Indian Creek appears to correspond to a regional depopulation during the Middle Archaic, as there are almost no radiocarbon dates from archaeological sites in the region that fall in that period, and projectile point types that are dated to this period are very scarce (Gleach 1987). Elsewhere in the Middle Atlantic Coastal Plain, Steponaitis (1980) and Wanser (1982) have noted an apparent scarcity of components dating to the 6000-5000 BC interval.

The issues relating to the regional Archaic chronology cannot be examined fully in the context of a single site excavation, but it was believed that the excavations at Site 7S-F-68 could provide additional information about this issue. Because the site's period of use spans what is traditionally defined as the Middle Archaic, the data recovery program provided an opportunity to examine Archaic population trends.

In Delaware, Custer (1984, 1986a) has identified a number of changes in technology, subsistence, and settlement for the Archaic period (ca. 6500 BC - 3000 BC), interpreted as gradual human responses to the emergence of full Holocene environmental conditions. Custer's model indicates that the onset of warm, wet conditions resulted in the extinction of certain cold-adapted grazing animal species and favored the expansion of browsing animals that flourish in such settings, such as deer. The Holocene environmental changes also facilitated the development of inland swamps and wetland areas, and human populations shifted from the more hunting-oriented foraging pattern of the Paleoindian period to one in which plant foods became a more important part of their economies. In southern Delaware, large swamp habitats such as Cedar Swamp and Burnt Swamp would have served as locations for the first large residential base camps, possibly occupied by several different family groups.

Associated with these larger group camps are more numerous and smaller procurement sites located in various settings that would have been favorable for hunting and gathering activities during different seasons of the year (Custer 1984, 1986a). The location of Site 7S-F-68 suggests that it would have served as a procurement site related to a settlement system that included base camps located at the margins of large wetland areas.

Based upon palynological and geomorphological data from the Middle Atlantic region, Custer's Woodland I period (ca. 3000 BC - AD 1000) has been described as a time of "dramatic change in local climates and environments" in which "a pronounced warm and dry period" (i.e., a mid-postglacial xerothermic) began at approximately 3000 BC and persisted to approximately 1000 BC (Custer and Bachman 1984). During that period, the mesic oak-hemlock forests of the Archaic were replaced by more drought-resistant (xeric) oak and hickory forests and more abundant grasslands. Although these conditions resulted in the loss of some interior streams, continued sea level rise resulted in the creation of highly productive and large brackish water marshes in the coastal zone. In essence, the xerothermic episode is hypothesized to have effected shifts in the distributions of plant and animal species and the establishment of new resource-rich settings in some areas of the state.

These shifts in climate, environmental conditions, and resource distributions are believed to have led to radical changes among resident prehistoric Native American populations, including a trend toward greater sedentism and more complex social organization. Major river floodplains and estuarine swamp habitats became the primary resource zones and the locations of large residential base camps occupied on a multi-seasonal or year-round basis. A number of these sites have been investigated in northern Delaware, including the Delaware Park Site, the Clyde Farm Site, the Crane Hook Site, and the Naamans Creek Site. In southern Delaware, there was an increase in the utilization of shellfish in the coastal areas, concurrent with an inland shift in the locations of macroband base camps along the tidal drainages. Within the Mid-Peninsular Drainage Divide zone, there is little evidence that site distribution patterns changed from the preceding Archaic period (Custer 1986a). The continuity in use of Site 7S-F-68 during the Archaic and Woodland periods suggests some similarity in the settlement and subsistence patterns during both periods.

The tool kits of Woodland I groups were generally similar to those of the Archaic, but with the addition of such items as heavy woodworking tools, soapstone and ceramic containers, broad-bladed points, and netsinkers. The increased abundance of plant processing tools over the preceding period suggests more intensive utilization of plant foods, which may have approached the level of productive intensification by the end of the Woodland I period. The presence of nonlocal lithic materials such as argillite, rhyolite, and soapstone is interpreted as an indication of incipient regional trade and exchange networks. The pit features and soapstone and ceramic vessels are viewed as items that facilitated more efficient food preparation and storage of surplus foods.

The Late Woodland or Woodland II period (ca. AD 1000 - AD 1650) within the Middle Atlantic region is marked primarily by the development of horticulture and increased sedentism. During this period, villages became larger and more permanent and tended to be located adjacent to areas with easily worked floodplain soils. Interregional trade and exchange systems appear to have diminished during this period. In southern Delaware, the Slaughter Creek complex is defined by the presence of Townsend ceramics, triangular projectile points, large macroband base camps and possibly fully sedentary villages with numerous food storage features. Most major sites assigned to the Slaughter Creek complex have been identified in the Delaware Shore, Mid-Drainage, and Coastal/Bay physiographic zones. Current Slaughter Creek complex settlement models indicate that the Mid-Peninsular Divide zone would have been used for special resource procurement sites (Custer 1986a).

2. *Subsistence*

The subsistence theme deals primarily with dietary composition and food procurement strategies. Archaic cultures in the eastern United States are generally characterized by a subsistence economy that combined hunting of game animals and gathering of plant foods. Archaeologists have used the notion of the Archaic period or developmental stage since the 1930s, and it has generally been applied to cultures that lack agriculture, fired clay ceramics, and permanent settlements. The beginning of the Archaic stage generally coincides with the onset of modern (Holocene) climatic conditions at the end of the Pleistocene glacial episodes (Custer 1990).

It is generally believed that human populations gradually increased during the Archaic period. Caldwell (1958) developed the model of "primary forest efficiency," which posited an increasing familiarity with the environment that allowed more efficient exploitation of seasonally abundant food resources within various micro-habitats of the eastern deciduous forest biome. Cleland's (1976) "focal-diffuse model" has also been widely used for interpretation of the changes in prehistoric subsistence patterns in eastern North America. Paleoindian technologies, characterized by a tool kit that seems oriented quite narrowly toward exploitation of herd animals, are viewed as focal adaptations; the ensuing Archaic adaptations, as evidenced by a greater variety of site types and tool kits, are seen as diffuse adaptations, with a subsistence base that included a broader variety of floral and faunal resources. Food production, best exemplified by the intensive use of corn and other domesticates during the Late Woodland period, is seen as a Late Focal adaptation, according to Cleland's model.

Archaeological techniques are generally suited to the reconstruction of subsistence patterns by direct identification of dietary refuse such as bone or botanical material. However, the preservation of bone and botanical material is unusual for open sites in the Middle Atlantic Coastal Plain. Faunal remains (bone and shell) have been recovered more frequently than plant foods, but this is possibly because sophisticated techniques for the recovery of floral remains are not in general use. Little is known of Archaic subsistence patterns in southern Delaware, and models (Custer 1984) are based largely on site location information and artifact assemblages. For the Woodland I period in Delaware, there is direct evidence of the use of shellfish, fish, and unspecified plant foods, as well as various fauna. Custer (1984, 1986a) has argued that the principal difference in the Archaic and Woodland lifeways is in social organization, rather than subsistence, although he suggests that the more sedentary settlements of the Woodland I period were based on changes in subsistence.

Because of the paucity of direct subsistence information in the Delmarva Peninsula and the surrounding Middle Atlantic region, a context for interpretation of subsistence behavior at Site 7S-F-68 must be developed by reference to a few sites scattered throughout the Middle Atlantic region and broader Eastern Woodland area. The earliest regular use of Site 7S-F-68 occurred during the Early Archaic, as represented by Palmer, Kirk, and various bifurcate-based points that are widely found throughout eastern North America.

The Early Archaic period was well represented at the Indian Creek Site in Prince Georges County, Maryland (LeeDecker et al. 1991), based on the recovery of Palmer, Kirk, and various bifurcate-based points. Flotation samples from the site contained 63 taxa, representing a wide variety of fruit, tubers, starchy seeds, nuts, shoots, and leaves. Nearly all of the charred, native botanical specimens represent species of known ethnographic use. Bone preservation at the site was virtually nil, owing to extremely acidic soils, but the site was interpreted as a gathering camp occupied during the spring, summer, and fall when plant foods would have been at their maximum availability. Residue analysis of the Indian Creek Site lithic assemblage suggested a faunal exploitation strategy that emphasized large game species (deer and bison/elk) but also included various other animals such as rabbit, bear, porcupine/beaver/squirrel, canines, fowl, fish, and rodents.

The Eva Site in Benton County, Tennessee, was utilized throughout the Archaic period. This site contained an abundance of fauna (deer, bear, raccoon, opossum, beaver, rabbit, muskrat, turkey, turtle, drumfish, etc.) but no archaeobotanical material was recovered. Analysis of the dietary remains indicated a heavy dependence on deer during the Early Archaic, but that the Late Archaic diet was supplemented by a wider variety of mammalian species as well as mollusc (Lewis and Lewis 1961).

An Archaic site with an extensive bifurcate point tradition was excavated at Rose Island, along the Little Tennessee River in eastern Tennessee (Chapman 1975). The Rose Island Site was interpreted as a base camp for one or more bands that occupied the site from the summer through the early winter. Subsistence data at the Rose Island Site were admittedly quite meager, and were supported by direct archaeological evidence only for the fall. Identifiable plant food remains associated with the bifurcate phase occupation at the Rose Island Site were limited to hickory nut, acorn, and honey locust seeds; of these, hickory nut and acorn comprised 99 percent of the total sample by weight (Chapman 1975).

The recovery of archaeobotanical remains is, in large measure, dependent on the application of flotation recovery techniques. Flotation recovery has been successful at a few Middle Atlantic sites, leading some investigators (e.g., Kauffman and Dent 1982) to challenge the prevailing view that Paleoindian and Early Archaic subsistence behaviors were almost wholly dominated by hunting. Botanical data present a unique set of interpretive problems, and it does not necessarily follow that all seeds, charred or otherwise, recovered from archaeological contexts represent plants that were consumed or intentionally used by the site inhabitants (Holt 1991; Keepax 1977; Minnis 1981; Moeller 1986; Smith 1985).

Relative to the Middle Atlantic region, botanical remains have been more frequently reported from sites in the Southeast and Midwest, particularly from rockshelters and deeply buried sites. Because the Archaic tradition encompasses the entire Eastern Woodlands area, it is assumed that archaeobotanical data from the Southeast and Midwest are in some measure applicable to the Middle Atlantic. Yarnell and Black (1985), using data from 60 sites in the Southeast, have compiled an important database pertaining to the prehistoric use of plant foods. First, there is widespread evidence that nuts (hickory, walnut, acorn, etc.), greens (e.g., purslane and pokeweed), fleshy fruits, small grains, and seeds were used throughout the Archaic and Woodland periods. Seed-to-nutshell ratios (computed as the number of seeds per 100 grams of nutshell) showed a steady increase through the Archaic, Early Woodland, and Middle Woodland periods, but dropped during the Late Woodland. Yarnell and Black also observed that the seeds of plants used for greens (purslane and pokeweed) declined after the Middle Archaic, while the numbers of small-grain-forb seeds (e.g., chenopod and amaranth) increased significantly during the Late Archaic and Woodland periods. Given these trends, they suggest that forb-grain utilization during the Late Archaic may have derived from the initial use of plants as greens (Yarnell and Black 1985).

At many sites with Early and Middle Archaic occupations, the complete absence of food remains is typical (e.g., Starbuck and Bolian 1980), and investigators must rely on indirect evidence to interpret subsistence behavior. For example, excavations at the deeply stratified St. Albans Site in Kanawha County, West Virginia, have produced indirect evidence that plant foods may have been an important element of Archaic subsistence strategy. In particular, the recovery of hoes or grubbing tools in association with Kirk and Kanawha levels suggests that plant foods were at least a dietary supplement during the Early Archaic period (Broyles 1971).

Late Archaic subsistence patterns are better understood than those of the Early and Middle Archaic, and existing models indicate reliance on a broader diversity of species as well as greater reliance on riverine resources. In the Outer Coastal Plain of the Middle Atlantic, shellfish gathering became increasingly important during the Late Archaic, and the shell middens found in the region's coastal areas and estuarine zones were first exploited intensively during the Late Archaic. Exploitation of riverine resources is also thought to have intensified in the Coastal Plain during the Late Archaic (Custer 1984; Gardner 1987; Waselkov 1982).

One of the hallmarks of the Woodland period is the introduction of agriculture, but there is little evidence in the Middle Atlantic region that cultivated foods played a significant role in the diet prior to the Late Woodland or Woodland II period. Although cultivated plants did assume greater importance during the Late Woodland, hunting and gathering of wild foods continued to overshadow food production (Custer 1984, 1986a). At the larger Woodland sites in Delaware, storage features are quite common, and the artifact assemblages frequently contain plant food processing tools, but there is only scant evidence of domesticated plants. A large trash pit excavated at the Wilgus Site (7S-K-21), a macroband base camp occupied during the Woodland I and Woodland II periods, contained large mammal, fish, reptile, and wild plant remains (Custer 1984, 1986a).

Recently developed techniques for the identification of residues on the surfaces of stone tools have raised the expectations of archaeologists that much new subsistence information may be forthcoming. The results in this area have not yet matched initial expectations, however, and there is much uncertainty regarding the utility of these techniques for archaeological analysis. A large-scale lithic residue analysis program for the Indian Creek Site collection has highlighted the difficulties archaeologists face in the interpretation of lithic residue test results (LeeDecker et al. 1991). In that analysis, a two-stage approach was utilized. The first level of testing was a simple presence/absence test. This was followed by test procedures designed to determine species. The results of the program have called into question common notions regarding stone tool form and function. Selection of the lithic specimens that were submitted for testing was guided to a large degree by the assumption that tools such as projectile points and formalized scrapers would yield the greatest amount of subsistence information. More than 500 specimens were tested at the Level I (presence/absence) stage, and this sample of the assemblage was heavily biased toward inclusion of formal tools. The remainder of the sample consisted of debitage, some of which was included as a control sample and some of which was selected because of size and formal characteristics that suggested potential use as expedient tools. The unexpected result of the analysis was the infrequency of blood residue on formal tools (points and scrapers) and the large amount of debitage that tested positive for residue.

Although the Indian Creek Site results suggest that visual inspection is not adequate to identify expedient tools in a lithic assemblage, it is important to appreciate that the processes by which animal residues might come in contact with a given lithic specimen extend beyond the slaying and butchering of an animal. Any tool or debitage discarded in an area that was subsequently used for butchering might come in contact with blood from a slain carcass and ultimately yield a positive test result. Therefore the assumption that all lithic specimens that yield positive residue test results were used as tools is no more erroneous than the assumption that a positive reaction for a particular species implies cultural use of that species. The reagents used in the Level II analysis actually detect the presence of specific immunoglobulins which are present in all body fluids (blood, sweat, and tears) and tissues (Newman 1990), so that the term "blood residue test" is somewhat misleading. Specific positive tests might reflect nothing more than the presence of animal urine, which might have been deposited on the surface of a stone tool without any human intervention.

3. *Settlement Patterns*

The settlement pattern theme pertains to a culture's adaptation to the environment, as viewed from a regional perspective. Settlement patterns are perhaps best viewed from the perspective of cultural ecology, a theoretical framework that seeks to understand specific cultural features and adaptive patterns, with particular attention to those aspects of culture that are closely related to the utilization of the environment (Steward 1955:36-37). The cultural ecology approach is particularly well suited to the study of prehistoric cultures, because many important aspects of these cultures are closely related to the biophysical environment.

In Delaware, Archaic and Woodland settlement patterns are generally characterized by seasonal movements through a series of habitats that provided various plant and animal foods at different times of the year. Different settlement types, distinguished by the group size and activities, were established during the annual round. Therefore, an examination of settlement patterns requires an understanding of the environment, including the regional distribution of microhabitats where important plant or animal food species may be clustered at certain seasons of the year.

Custer's (1984, 1986a) Archaic settlement pattern model includes macroband base camps, microband base camps, and procurement sites. The Woodland I settlement pattern is similar to the Archaic model in that it includes the same types of sites, but the Woodland I macroband base camps are much larger than the Archaic macroband base camps. The Woodland II settlement system also includes the same three basic site types, but there are several distinct models that assume different seasonal movement between environmental zones. For the Mid-Peninsular Drainage Divide zone, only procurement sites and microband base camps are predicted, as macroband base camps would have been located in the coastal zone or along the lower reaches of major drainages (Custer 1986a).

Many archaeological settlement pattern studies in Delaware and the Middle Atlantic region have been based on regional surveys and museum collections, so that while there is some understanding of the varying use of specific resource zones, the understanding of some specific site types is relatively limited. The models constructed from these studies are robust in the sense that they are derived from large data sets, but they suffer from the fact that very few sites have been excavated to an extent sufficient to render them understandable in the context of their immediate environmental setting. This is particularly true for the Archaic period and for small Woodland sites.

In the Middle Atlantic region, the most comprehensive settlement pattern studies have been completed by William M. Gardner and his associates. The principal focus of Gardner's research has been the

Paleoindian and Early Archaic periods. Based on extensive research in the Shenandoah Valley of Virginia, Gardner has suggested that a significant shift in the settlement pattern occurred during the Early Archaic period, accompanying the shift to notched projectile point forms (Kirk and Palmer types). The most notable aspect of this change was the appearance of processing stations along floodplain margins (Gardner 1974:24). Gardner has interpreted the appearance of these processing stations with respect to changing environmental conditions that occurred during the early Holocene, specifically the replacement of the late Pleistocene regime by a mixed coniferous-deciduous forest. The mixed coniferous-deciduous forest would have supported a broader variety of exploitable plant and animal species, particularly along the margins of inland swamps and bogs, and these microenvironments were quite favorable for the hunter-gatherer populations of the Early Archaic.

Excavations at the Fifty Site (44WR50) have provided the basis for much of Gardner's interpretation of Early Archaic settlement and subsistence patterns. This site was located adjacent to a backswamp area along the South Fork of the Shenandoah River, and it contained a sequence of stratified Early Archaic living floors and activity areas (Carr 1974). The backwater swamp adjacent to the site would have supported a diversity of edible wildlife species, including small mammals, waterfowl, and plant foods, and this habitat was believed to have been the primary attraction for the Early Archaic groups that inhabited the site. However, the Fifty Site did not contain well-preserved faunal or floral remains, and the interpretation of the site as a food processing station was based primarily on a lithic tool assemblage that contained large chopping and scraping tools. These tools (large utilized flakes and bifaces) were described as implements that would have been used for butchering migratory waterfowl and various mammalian species. Although no plant food remains or plant food processing tools were recovered, it was reported that the environmental conditions of the site area were favorable for exploitation of both plant and animal foods (Carr 1974).

In the Delmarva Coastal Plain, Custer has observed that the most significant adaptive change associated with the beginning of the Archaic is a difference in the choice of site locations. In the Delmarva region, this settlement shift is seen as an increased emphasis on the swamp and marsh habitats that developed at the beginning of the Atlantic climatic episode. Custer notes that the settlement shift is perhaps most apparent in the Piedmont, Valley and Ridge, and Great Valley regions of the Middle Atlantic, where there is an increased use of upland sites. Custer defines three principal site types: macroband base camps, microband base camps, and procurement sites. Macroband base camps, the largest settlements, were located at the emerging swamp and marsh habitats, while the microband base camps were located on smaller tributary streams that provided access to lithic resources and game. Procurement sites were located in a variety of settings which were attractive to game or which provided specialized non-food resources (Custer 1984, 1986a).

Middle Archaic settlement models for the Middle Atlantic region are not well developed, and there is a lack of agreement among archaeologists regarding the bracket dates for that period. Gardner and many of his associates use a beginning date of circa 6500 BC for the Middle Archaic, arguing that the bifurcate-based points represent the initial phase of this period. Other investigators place the bifurcate-based points in the Early Archaic and use a more recent date of circa 6000 BC for the beginning of the Middle Archaic. Regardless of whether or not the bifurcate-based points are considered Early Archaic or Middle Archaic, there is a paucity of data pertaining to the interval between 6000 BC and 4000 BC. Custer's (1984) compilation of radiocarbon dates for Delaware and Maryland's Eastern Shore indicates an apparent absence of cultural activity for this period. Wanser (1982) has examined collections from southern Maryland (Charles and St. Marys counties), which includes the Zekiah Swamp area, one of the resource zones used most heavily during Maryland's prehistory. The collections generally support Gardner's assertions that there was an increasing focus on interior swamps during this time, but Wanser concluded that there were anomalous patterns in the frequencies of diagnostic points for the Middle Archaic (circa 6000 to 4000 BC).

Stewart and Cavallo (1991) have recently summarized Middle Archaic data for the Delaware Valley, addressing issues of chronology, settlement pattern, and subsistence. They bracket the Middle Archaic to the period circa 8500-5000 BP, and they argue that bifurcate-based points represent the first major element of this period. Based on excavations at the Abbott Farm National Landmark and other sites, they identify a number of Middle Archaic contexts that have yielded triangular points. Their settlement pattern model for the Middle Archaic includes three site types: Base Camp/Staging Areas (Type A); Limited Activity Transient Camps (Type B); and Individual Activity Areas or Stations (Type C). Type A sites were occupied by the maximum group size and were located in areas that afforded access to a wide variety of resources. Type B sites were occupied by smaller groups and would have been used on a seasonal or as-needed basis; this site type includes the Procurement Site type defined by Custer (1984). Type C sites were also used on a seasonal or as-needed basis and were used by individuals or small groups (Stewart and Cavallo 1991).

In the Middle Atlantic Coastal Plain, the Late Archaic is generally viewed as a period of population increase, with evidence of increased sedentism and larger population aggregates. In Delaware, Custer subsumes the traditional Late Archaic period into his Woodland I period. In that period, he has observed that the distinctive characteristics of the settlement system are (1) the presence of base camps along major drainages that supported much larger population aggregates and (2) a corresponding abandonment of sites in other locations. The intensification of settlement in the major riverine zones is possibly related to the warm, dry conditions associated with the Subboreal climatic episode, which possibly decreased the carrying capacity of marginal areas that were exploited during the Atlantic climatic episode (Custer 1984, 1986a).

For southern New Jersey, Kraft and Mounier (1982) have observed that Archaic sites are found primarily in riverine, lacustrine, and coastal settings. They argue that by the Late Archaic a centrally based wandering settlement system had been achieved. Although the settlement pattern was focused primarily on riverine zones, sites located on the divides between drainages, like Site 7S-F-68, were functionally related to this settlement pattern.

Custer (1984, 1986a) has described the change from Archaic to Woodland settlement patterns as essentially a shift from a mobile to a more sedentary pattern. This shift was manifested by the appearance of large base camps in riverine and estuarine settings and by a corresponding reduction in the variety of exploited micro-habitats. For the Woodland I settlement pattern, Custer indicates that the three basic Archaic site types persisted: macroband base camps, microband base camps, and procurement sites. However, Woodland macroband base camps were larger than the corresponding Archaic site type, while the range of activities carried out at microband base camps and procurement sites decreased (Custer 1984, 1986a).

The addition of domesticated foods to the diet led to important changes in the Late Woodland or Woodland II settlement patterns. However, Stewart et al. (1983) have summarized data for the Late Woodland in the Delaware Valley and Upper Delmarva Peninsula, and noted a general continuity in settlement/subsistence systems from the Middle to Late Woodland periods. In general, Late Woodland settlement patterns were characterized by an increasing sedentism, which was reflected in larger villages located adjacent to areas of easily tilled soils, the construction of more permanent structures, and the increased use of food storage facilities (Custer 1984, 1986a).

For southern Delaware, a number of distinct settlement pattern models have been proposed for the Late Woodland Slaughter Creek complex (Thomas et al. 1975). The original models developed by Thomas et al. (1975) were based on an extensive survey of environmental resources available in the Delaware Coastal Plain, and they included three basic site types: (1) seasonal camps, (2) permanent and semi-permanent camps, and (3) transient camps. In Custer's (1984, 1986a) recasting of these models, seasonal camps correspond to microband base camps, while permanent and semi-permanent camps correspond to Custer's macroband base camp site type. Transient camps, as defined by Thomas et al., were used for short-term forays on a seasonal or as-needed basis. This site type would include hunting camps, and would correspond to Custer's procurement site type. An important element of the models developed by Thomas et al. is the delineation of resource zones, each with a distinct suite of exploitable resources. Site 7S-F-68 would be located in the Poorly Drained Woodland zone, a resource area that occupies a wide area of the Mid-Peninsular Drainage Divide in Sussex County. Each of the five models assumed seasonal movement or forays between the different resource areas. Based on the resource survey, the Poorly Drained Woodland zone would have been most attractive for exploitation during the winter to early spring (Model 1), fall to late winter (Model 4), or late fall and winter (Model 5) seasons.

A number of explicit settlement models for the Woodland period have been developed in conjunction with investigations at the Abbott Farm National Landmark, located in the Middle Delaware Valley (LBA 1983, 1987). Five basic site types were defined for these models: macro-social unit camps, micro-social unit camps, transient camps, specialized camps, and stations. The macro-social and micro-social units are comparable to Custer's similarly named site types, while the transient camp and specialized camp would generally correspond to the procurement site type. For the Late Archaic and Early Woodland, the principal site types were the macro-social unit camp and the transient camp. In Model I for this period, the macro-social unit camps were occupied for only a short part of the year, possibly during the early spring to early summer and again in the late summer to early fall; during the remainder of the year, smaller groups moved between transient camps. Model II for the Late Archaic/Early Woodland postulates that the macro-social unit camps were occupied for a longer duration, and the transient camps were used for correspondingly shorter visits. By the Middle to Late Woodland, greater sedentism is evident in the settlement pattern. In Model I for this period, a single macro-social unit camp was occupied for a significant part of the year in a resource-rich setting, and all other exploitative activities would have been carried out by small groups using transient camps and stations. Model II postulates a seasonal movement of the entire co-resident group between macro-social unit camps in different resource zones (LBA 1983, 1987).

4. *Intrasite Patterning*

Investigation of the site structure focuses not only on the identification and spatial delineation of activity areas, but also on site formation, which is a closely related issue. Given the lengthy period during which Site 7S-F-68 was utilized by prehistoric groups, there should be little doubt that many different activities were carried out within the same relatively restricted space. Notwithstanding the preservation of features in subsoil contexts, the mixing of material associated with different occupations of the site should be expected. Although the individual episodes of site occupation may have been quite restricted in scope, the succession of occupational episodes would produce a complex of overlapping patterns, a situation that might be clarified only by intensive analysis.

Based on ethnographic information from various hunter-gatherer societies and excavation data, Binford (1983) has identified a number of cross-cultural similarities in the way individuals and groups carry out tasks and discard debris in residential and nonresidential sites. Within a campsite, hearth areas are normally the foci around which a broad range of activities are carried out, and Binford (1983:149) suggests that these activities were not only organized around hearths but were performed "according to a spatial pattern that appears to be universal." Site structure may be viewed as a conglomerate of individual modules that represent either distinct activities or social units. The representation of social structure in space is a culturally universal phenomenon, and occupation sites often contain a series of small areas of equivalent size and form that correspond to social units such as households or extended families.

The patterning of refuse deposits around hearths typically exhibits a concentric form. Small items, such as waste products from craft activities, are normally found between the hearth and the seating area, while larger items are discarded in a "toss zone" away from the primary seating and work area. There are a few basic patterns of refuse disposal among hunter-gatherers that account for the major patterns of archaeological site structure. These basic disposal modes include: (1) dropping or discarding objects in their place of use, (2) tossing individual items away from their place of use or consumption, and (3) dumping a group of items en masse. Small dumps often appear to have a "magnetic" effect, as they accumulate material from subsequent refuse disposal episodes (Binford 1983).

Distinct disposal patterns may be observed inside and outside of structures. While the concentric, or donut-shaped, pattern of refuse is typically left by groups around an outside hearth, greater effort is normally made to maintain the cleanliness of indoor domestic spaces. Refuse dumps are typically located immediately outside the door, left there after the cleaning of a domestic space. Activities that produce large amounts of waste material are typically located away from the primary living area, so that debris may be left in place at some remove from the primary living space. Sites that are intended for reuse, including the peripheral areas adjacent to the primary habitation areas, are typically cleaned of debris (Binford 1983).

While ethnographic sources (e.g., Binford 1983; O'Connell 1987; Yellen 1977) provide an important context for interpretation of structure, interpretation of behavioral patterns must also be grounded on a comprehensive understanding of site formation processes (Schiffer 1987). Site formation issues must be addressed by a site-specific program of soils and geomorphological analysis, crossmending or refitting of artifacts, and analysis of the internal distribution of features and refuse deposits.

5. *Technology*

Lithic artifacts provide the principal avenue for addressing issues relating to technology. Stone tools and the debris from their manufacture, maintenance, and recycling comprise the lithic record of a prehistoric society or culture. This record is a partial reflection of a society's technology--its strategies for interacting with its biophysical and social environments. How a society organizes its technology provides important insights into the economic and social structure of that society (Koldehoff 1987; Nelson 1991). These facts, coupled with the durability of stone at the material of tool technology, underscore the amount of potential information that can be gleaned from lithic artifacts.

Five basic categories of information can be derived from lithic artifacts: depositional, temporal/stylistic, functional, technological, and raw material. These aspects of the lithic record are all interrelated and cannot be completely divorced from one another. Raw material analysis identifies the lithic materials that were manipulated; this information permits inferences to be made about procurement strategies and the related issues of exchange and settlement mobility. Technological analysis examines tool design and methods of production, maintenance, and recycling;

this information helps to document the organization of technology and address topics such as site function. Functional analysis determines the tasks in which tools were employed; this information also helps to document the organization of technology and site function. Temporal/stylistic analysis provides chronological as well as other cultural information; unfortunately, only the most formalized stone tools are temporally diagnostic (e.g., projectile points), and even these items tend to be less sensitive to temporal change or regional styles than are ceramics. Information about depositional processes helps to identify activity areas, tool kits, and larger-scale site formation processes; this information is derived from crossmending artifacts and plotting artifact distributions.

6. *Environmental Adaptation*

The environmental adaptation theme examines cultural response to changing environmental conditions. Given the lengthy period during which Site 7S-F-68 was used and the region's paleoclimatic history, the archaeological record at the site would be expected to reflect cultural responses to changing environmental conditions. Specifically, these changes would be reflected in the composition of tool kits and in the subsistence patterns. Subsistence and settlement pattern issues, discussed above, pertain directly to the environmental adaptation theme, and reconstruction of past environmental conditions provides the necessary context for examination of this theme. Carbone (1976) and Custer (1984) have provided important baseline information for the region, and these syntheses may be expanded by other available data (e.g., Brush 1990; Thomas et al. 1975; Watt 1979).

C. METHODOLOGY

1. *Sampling Strategy and Field Methods*

The program devised for data recovery was based on a sampling plan that included three principal components: (1) excavation of block areas centered on productive loci of the site identified during the Phase II fieldwork, (2) exploratory excavations to provide a better spatial sample of the site area, and (3) expansion of block areas to recover significant features and deposits identified during the exploratory excavations.

On the basis of the Phase II testing, two areas were identified for expansion of block excavations. The first of these, identified as the North Excavation Block, was centered on Test Units 9 and 10, which contained a charcoal feature (Feature 2) and the largest number of diagnostic artifacts. This block also encompassed Test Units 5 and 11, as these units contained pottery and diagnostic points. The second block area, identified as the South Excavation Block, encompassed Test Units 1 and 7, which represent the downslope area of the site. Test Unit 1 contained an Early Archaic point and Test Unit 7 contained a fragmentary point whose morphology suggests an Early Archaic form.

A few exploratory units were scattered throughout the site to provide a spatially more representative sample, although the site area had been fairly well tested during the Phase II fieldwork. Reserve units were used to enlarge block excavations around significant features or deposits.

Altogether, the data recovery excavations encompassed an area equivalent to approximately 25 percent of the site area within the right-of-way. The site is estimated to cover an area of approximately 700 square meters (20x35 meters), and a sample of approximately 3 percent was obtained during the previous fieldwork. During the data recovery program, an additional 173 square meters of the site area were excavated, providing an overall excavation sample of 28 percent of the site. Figure 5 portrays the spatial sampling obtained during the Phase II and III fieldwork.

The excavation methodology followed the field techniques used in the Phase II testing program, to permit integration of the results of both phases of excavation. During the testing program, a vertical datum and a horizontal grid system were established for the site, and these were reestablished and used as the primary spatial control systems for the Phase III fieldwork.

The primary excavation units were 2x2-meter squares, although some units in the excavation blocks were necessarily smaller to accommodate the standard unit size (1x2-meter) employed during the Phase II fieldwork. The plowzone was removed as a single level, and then the underlying subsoil levels were removed according to 10-centimeter levels. Within each unit, subsoil levels were excavated according to quadrants (1x1-meter squares), in order to permit more refined spatial analyses. Features and soil profiles were drawn to scale and photographed using black-and-white and color slide film. Excavated soils were described according to standard USDA soil textural classes and Munsell soil color notation.

The Phase II investigations demonstrated the presence of historic artifact deposits in some areas of the site. These deposits appeared to represent modern litter and generalized sheet refuse associated with a farmhouse located outside the right-of-way, and they were not considered significant (LeeDecker et al. 1992). Because a sample of the site's nineteenth-century and

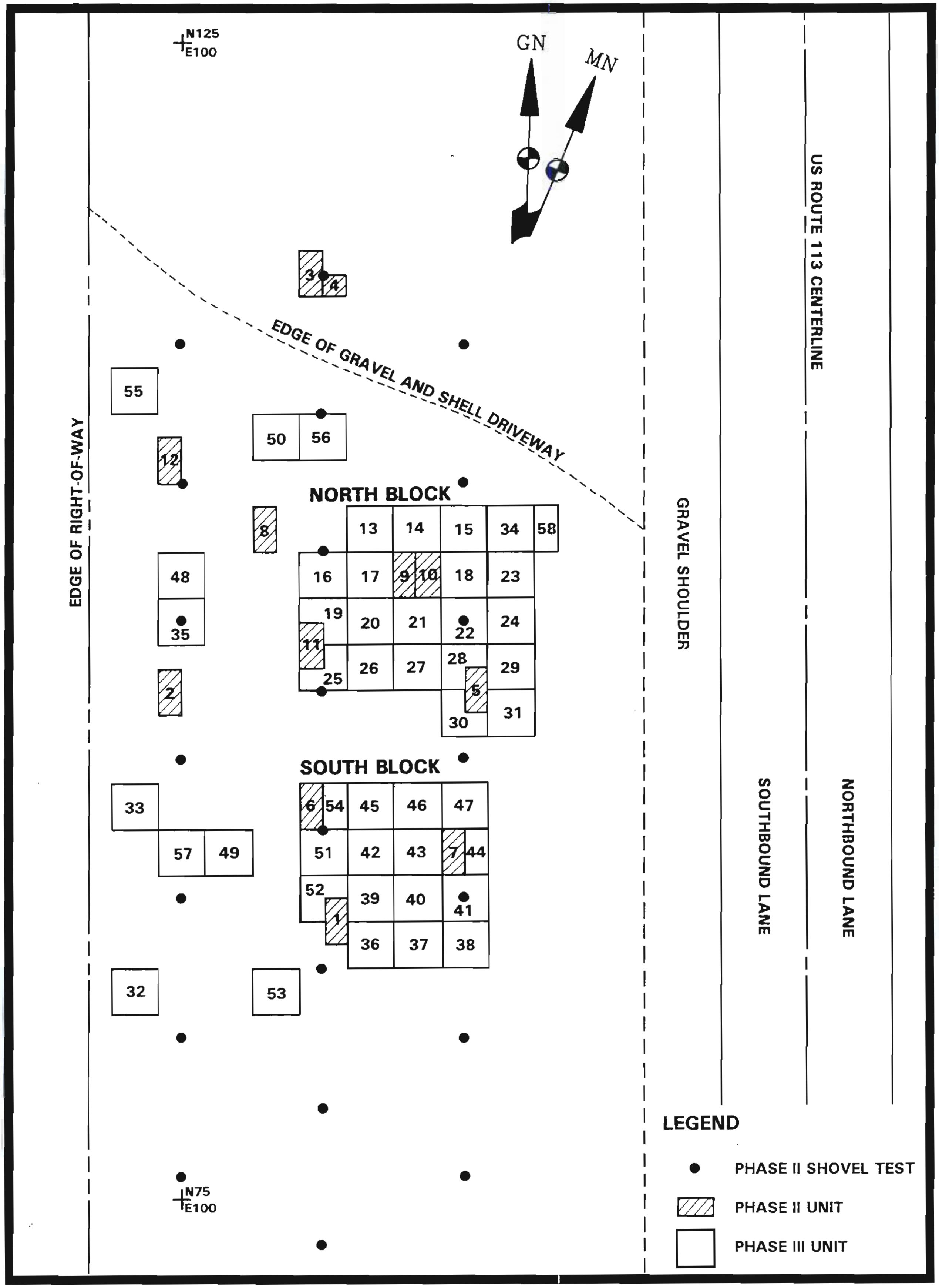


FIGURE 5: Spatial Sampling in Phase II, and III Fieldwork

twentieth-century material was obtained during the Phase II investigations, material of this type was not retained during the Phase III excavations. Historic artifacts recovered during the Phase III fieldwork were examined and discarded after a determination that they did not represent a significant resource.

2. *Artifact Processing and Analytical Methods*

A substantial artifact collection from the site had already been processed and analyzed for the preceding Phase I and Phase II investigations. In order to take full advantage of the existing analytical information, the artifact processing and analysis for the data recovery program followed the same overall laboratory procedures. This allowed integration of new information into the database already established for the site.

The artifact collections were processed for eventual storage and curation by the Delaware State Museum. Artifacts were assigned accession numbers according to the system utilized by the Island Field Museum. The assigned accession numbers for Site 7S-F-68 are as follows:

Accession Number	Phase
89/41	I
91/33	II
92/159	III

In addition to the accession numbers, unique catalog numbers indicating field provenience within the site were also assigned. After cleaning, the tools and diagnostic artifacts were marked with the accession number and catalog number. Tools and ceramics were then separated from debitage and the material was cataloged by the appropriate analyst or laboratory technician. After analysis, the collections were sorted according to major classes (bifaces, unifaces, cobble tools, cores, debitage, fire-cracked rock, etc.) and placed in resealable plastic bags with a card containing the full site provenience, the date of excavation, the excavator's initials, the catalog number, and the accession number.

Artifact cataloging and tabulation were accomplished by a computerized database system developed by the LBA Cultural Resource Group. The database was developed using the MicroRim Inc. R:BASE System V relational database software package, which runs on IBM PC XT and compatible microcomputers. The overall database for this project contains four principal files: (i) provenience, (ii) prehistoric artifacts, (iii) historic artifacts, and (iv) floral and faunal material. An overview of the information in the principal files is presented below.

Full field provenience information was included in the provenience file: *Catalog Number*, *Site*, *Unit*, *Unit Level*, *Stratum*, *Feature*, *Feature Level*, and *Quadrant*. The majority of these fields were taken directly from the field excavation records and are therefore self-explanatory. During fieldwork, a sequence of catalog numbers was assigned to the provenience list, so that each unique provenience could be identified by a single number. In addition, a *Remark* field was added to the database to accommodate additional explanatory information about specific contexts. Additional fields to identify excavation blocks and interpreted depositional units were subsequently added to the provenience table to facilitate analysis of intrasite patterning.

LBA's cataloging system for prehistoric artifacts has been formalized in a system known as *Lithica* (Taylor and Koldehoff 1991). The analytical approach applied can be described as technomorphological; that is, artifacts are grouped into *classes* and then further divided into *types* based upon key morphological attributes, which are linked to or indicative of particular stone-tool production or reduction strategies. However, a function(s) can be assigned to each artifact class and type. More detailed functional assessments of artifacts can be made by recording specific observations about use-wear and tool morphology. Data derived from experimental and ethnoarchaeological research are relied upon in the identification and interpretation of artifact classes and types. The works of Callahan (1979), Clark (1986), Crabtree (1972), Flenniken (1981), Gould (1980), and Parry (1987) are drawn upon most heavily. Descriptions of the tool and debris types are contained in Chapter VII.

For prehistoric pottery sherds the following attributes were recorded: vessel portion, temper, surface treatment, thickness, count, and weight to the nearest tenth of a gram. Thickness was measured with vernier calipers, but only for sherds with intact surfaces (i.e., uneroded). Because the assemblage is relatively small and very fragmentary, the above attributes, excluding the metric attributes, were not recorded as a series of codes. Rather, they were simply recorded as text in a note field. Sherds were assigned to established ware types, if possible. Burned clay fragments were counted and weighed, but because of their small size and eroded nature, little can be inferred from them.

Historic artifacts were cataloged according to standard typologies (e.g., Noel Hume 1970; South 1977), using the class, type, and variety approach (for example, class = glass, type = bottle, variety = case). First, the collection was sorted according to major classes--ceramics, curved glass, pipes, and small finds. The small finds class is a residual or catch-all category that comprises a broad variety of items, including artifacts assignable to South's (1977) Architectural, Furnishings, Arms, Personal, Clothing, and Activities groups. Because significant historic deposits were not recovered, cataloging of the ceramics and glass was carried only to the level of individual sherds, rather than vessels, and no crossmends or Minimum Number of Vessel determinations were made. Cataloging was accomplished by use of alphabetic and numeric codes for the various attributes, but more lengthy "translations" were generated for printing catalog sheets. For example, the codes "CRW 10" translates to "Ceramic, whiteware, shell-edged blue," with an automatically entered date range of 1820 to 1900. During data entry, some of the attributes--date ranges, for example--were automatically entered by the computer for commonly encountered artifact types.

Cataloging and analysis of the floral and faunal material samples were completed by a consultant, and the catalog was subsequently integrated into the overall database. For each specimen, the recorded data includes species identification, count, weight, and other modification. Cataloging procedures used for the floral and faunal material are described in Chapter VIII.

V

ARCHAEOLOGICAL FEATURES

Forty-one features were identified at the site during the various Phase II and Phase III excavations (Table 5). These include a variety of prehistoric and historic features, as well as noncultural soil anomalies that were assigned feature numbers during excavation. In many cases, the field identification and interpretation of prehistoric features was quite difficult, because of the character of the soils. The nine historic human burials identified at the site are reported in a separate study (LeeDecker et al. 1995). Figure 6 (end pocket) illustrates the distribution of features throughout the site.

A. PREHISTORIC FEATURES

The prehistoric features include a group of 11 informal cooking/heating areas represented by charcoal concentrations (Features 2, 8, 12, 17, 18, 19, 20, 23, 24, 25, and 26), three clusters of tools that represent either tool caches or activity areas (Features 21, 22, and 33), and one cooking/heating area represented by a scatter of fire-cracked rock (FCR), charcoal, and discolored soil (Feature 31).

Informal cooking/heating areas (Features 2, 8, 12, 17, 18, 19 20, 23, 24, 25, and 26) were the most numerous prehistoric feature type at the site, and they were visible only as areas of charcoal flecking within slightly discolored soil. These features may represent cooking or heating areas such as hearths or fire-pits. They typically appeared in the subsoil (Stratum B) and were distinguished primarily by the presence of charcoal rather than soil color differences. The boundaries of the features were often somewhat indistinct, and the soils within the features were not readily distinguishable from the surrounding matrix in terms of reddening or compaction. The 11 features in this class have mean length, width, and depth measurements of 57x39x17 cm (Table 6). Figure 7 illustrates the long-axis profiles for these features. Their plan view and distribution within the site is shown on Figure 6.

Feature 31, located in the South Excavation Block (Excavation Unit 52) was the only cooking/heating area that included a significant amount of fire-cracked rock. This feature extended over an area measuring approximately 50x77 cm, and included a total of 355 gm of fire-cracked rock. Within the feature, the fire-cracked rock was loosely scattered, and the feature soil exhibited a slightly reddish cast. A few charcoal flecks were also recovered from the Feature 31 matrix, as were a number of chert, jasper, and quartzite flakes. Spatial analysis (see Chapter VII) indicated that refuse deposits associated with the Early Archaic occupation of the site were concentrated in the area adjacent to Feature 31; therefore, Feature 31 is interpreted as a probable Early Archaic hearth area.

Three features were represented by tool clusters indicating activity areas or tool caches. Feature 21 (Plate 3), located in Unit 48, contained a cobble chopper, a bifacial hoe blade, and a small cluster of fire-cracked rock (315 gm). This assortment of tools and debris appears to represent a small processing area. Blood residue tests were undertaken for the chopper, the hoe blade, and the largest piece of associated fire-cracked rock, but none of the three items tested positive. Refuse deposits associated with the Paleoindian and Early Archaic occupations were concentrated adjacent to this feature; therefore, it is probably associated with the Paleoindian or Early Archaic use of the site.

Feature 22, located in the South Excavation Block (Unit 42), included a mano and metate lying side by side (Plate 4). The mano or hammerstone was made of quartzite and it exhibited evidence of mano and anvil use. The metate was a large slab of igneous/metamorphic rock with a shallow, concave abrading surface. The tool cluster represented an obvious plant processing station, and the tools were submitted to an outside laboratory for identification of pollen remains. The metate contained sufficient residue to permit a 100-grain pollen count, and various arboreal (oak, beech, hickory, walnut black locust, and pine) and nonarboreal taxa (goosefoot/amaranth, ragweed, meadow rule, pink family, plantain, grasses, ground cherry, and sedge) were identified. Pollen identified on the metate were dominated by arboreal species, and many of the nonarboreal taxa identified are indicators of disturbed ground. Analysis suggested that goosefoot/amaranth might represent plant foods processed or consumed at

Table 5: List of Features, Site 7S-F-68

FEATURE	UNIT	DESCRIPTION/COMMENTS
1	3, 4	Dog burial
2	9, 10	Charcoal concentration; C14 date of 1140 $\pm$ 60 years BP
3	8	Irregular organic stain; tree disturbance
4	13	Modern geological boring
5	15, 18, 23	Historic human burial
6	16	Irregular organic stain; tree disturbance
7	23	Soil disturbance; looter's trench or automobile tire rut
8	18	Irregular organic stain with charcoal flecking
9	23, 34	Historic human burial
10	35	Tree or rodent disturbance
11	35	Historic post hole
12	35	Irregular organic stain with charcoal flecking
13	35	Tree or rodent disturbance
14	35	Rodent disturbance
15	34, 58	Historic human burial
16	28	Historic posthole/post mold
17	25, 26	Irregular stain with charcoal flecks; C14 date of 1020 $\pm$ 70 years BP
18	28	Oval soil stain with charcoal flecks
19	38	Irregular soil stain with charcoal; C14 date of 2460 $\pm$ 130 years BP
20	47	Irregular organic stain with charcoal; C14 date of 310 $\pm$ 80 years BP
21	48	Prehistoric activity area/tool cache with cobble chopper and hoe
22	42	Prehistoric activity area/tool cache; anvil/mano and metate; probable Early Archaic activity area
23	21	Circular, basin-shaped stain with charcoal flecks
24	49, 57	Soil stain with charcoal flecks; C14 date of 2640 $\pm$ 110 years BP
25	45	Irregular organic stain with charcoal flecks
26	29	Irregular organic stain with charcoal flecks
27	53	Organic stains with charcoal flecks; tree roots
28	39	Charred root fragments
29	50, 56	Historic human burial
30	50	Historic human burial
31	52	Scatter of fire-cracked rock and charcoal flecks in slightly reddened soil; probable Early Archaic hearth
32	56	Soil disturbance; Phase I shovel test
33	41	Large argillite biface associated with argillite debitage
34	58	Looter's trench or utility line trench
35	*	Dog burial
36	*	Historic human burial
37	*	Dog burial
38	*	Historic human burial
39	*	Historic human burial
40	*	Historic human burial
41	*	Historic posthole

*: Feature identified during topsoil stripping operations

the site, but it did not occur in a high frequency. It was concluded that little if any of the pollen represented material associated with the site's prehistoric use (Kelso 1992). Blood residue tests were undertaken for the mano and the metate, but neither item tested positive. Because of its spatial association with Early Archaic refuse deposits, Feature 22 has been assigned to the site's Early Archaic component.

Feature 33, a small lithic workshop area located in the South Excavation Block (Unit 41), was represented by a large, early-stage argillite biface and four

Table 6: Metric Data for Prehistoric Charcoal Features

FEATURE NO.	LENGTH	WIDTH	DEPTH
2	60	*	9
8	54	30	9
12	50	*	10
17	62	*	20
18	23	20	12
19	70	62	27
20	44	44	25
23	34	34	22
24	80	40	20
25	40	*	21
26	107	45	14
MEAN	57	39	17
MINIMUM	23	20	9
MAXIMUM	107	45	27

* no observation, because feature extended outside excavation unit or block.
All measurements given in centimeters.

argillite flakes. The largest piece of debitage associated with the feature was submitted for blood residue testing, but it did not test positive. The cultural origin of this feature is uncertain: Its spatial provenience suggests association with the site's Early Archaic component; however, argillite appears to have been used most frequently during the Late Archaic/Early Woodland period.

The majority of the prehistoric features are of uncertain age, and none included culturally diagnostic projectile artifacts. The cooking/heating features typically contained charcoal flecks, which in a few cases occurred in sufficient amounts to allow radiocarbon age dating. The five features (Features 2, 17, 19, 20, and 24) that did contain sufficient charcoal to permit radiocarbon dating (see Table 5) provided dates ranging from the Early Woodland through the European Contact periods. Based on lithic raw material, some of the features may be tentatively assigned a temporal position because certain raw materials are associated with a specific period of site occupation (see Chapter VII). Feature 21, which included two large quartzite tools, may be associated with the site's Early Archaic component, because of the association of quartzite with Kirk Stemmed points. Likewise, Feature 33, which consisted of a cluster of argillite debitage and an early-stage biface, may be associated with the site's Late Archaic component, because argillite was used only for Late Archaic projectile point types.

Soil samples were taken from each feature for flotation processing, but the flotation samples contained very little analytically significant botanical material (i.e., charred native species). However, three of the features contained charred sumpweed *(Iva annua)*, an indigenous annual seed plant which played an important role in the transformation from hunting and gathering of wild plants to cultivation in eastern North America. Sumpweed was present in feature contexts dating to 2460 $\pm$ 130 years BP (Feature 19), 1020 $\pm$ 70 years BP (Feature 19), and 310 $\pm$ 80 years BP (Feature 20). The importance of sumpweed in North American aboriginal subsistence is discussed more fully in Chapter VIII. Other botanical material associated with the prehistoric features includes Sumac *(Rhus spp.)* from Feature 18 and Woodbine or Virginia Creeper *(Parthenocissus quinquefolia)* from Feature 23.

While the prehistoric feature inventory is dominated by cooking/heating features, there is a general lack of the fire-cracked rock that is often associated with prehistoric hearth areas. Located in the Mid-Peninsular Drainage Divide area of the Delmarva Peninsula, the immediate site environment does not contain any readily accessible sources of rock suitable for use in hearths. The local Coastal Plain deposits are comprised virtually entirely of sand, silt, and clay, and there are no stream beds that might contain suitable gravel bar deposits. Apparently, therefore, the scarcity of fire-cracked rock at Site 7S-F-68 reflects the lack of suitable lithic material in the site catchment area.

A variety of aboriginal cooking methods are known from the ethnographic literature, including roasting over dry heat, container boiling, and steaming

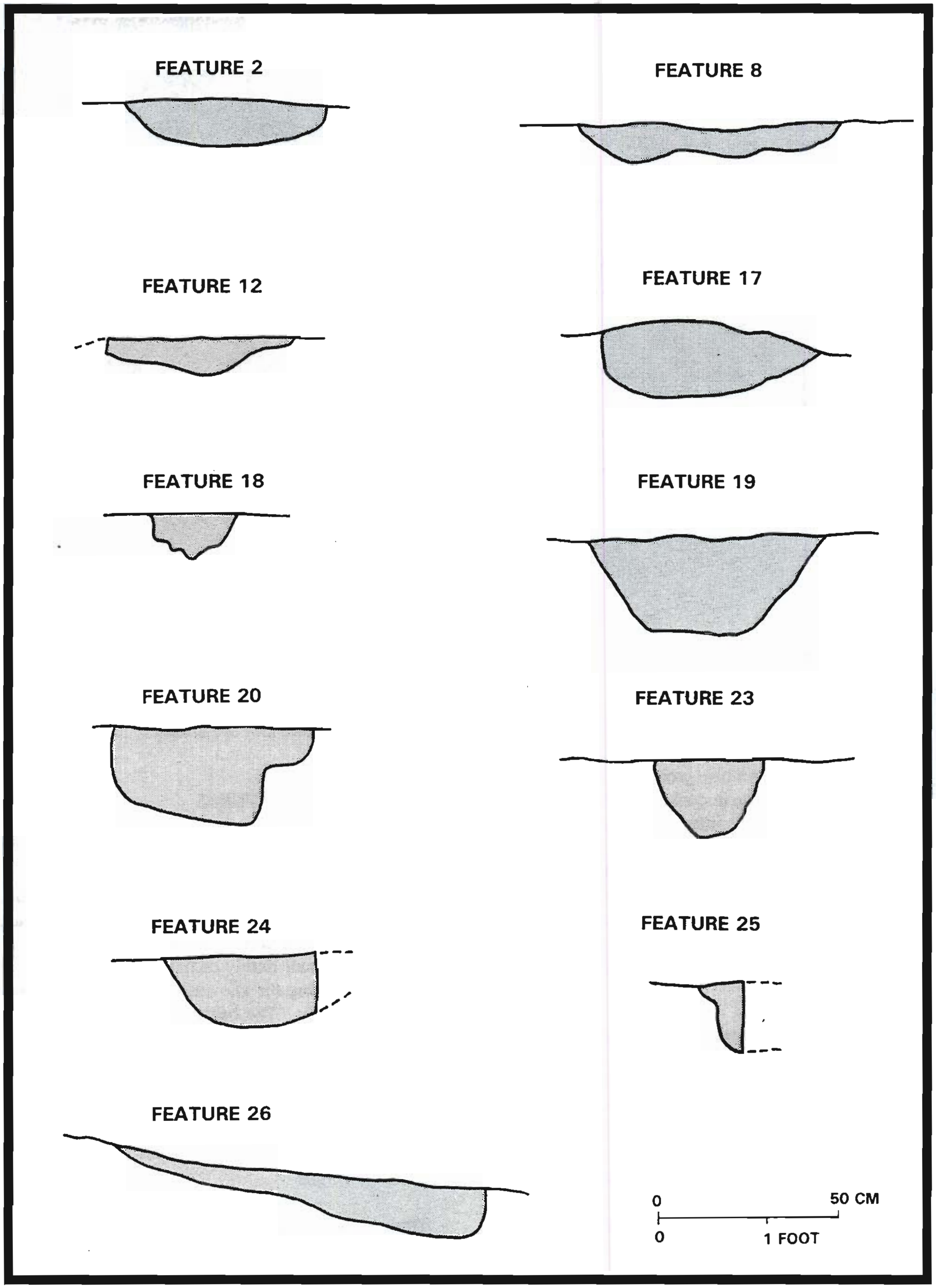


FIGURE 7: Long-Axis Profiles of Informal Cooking/Heating Features

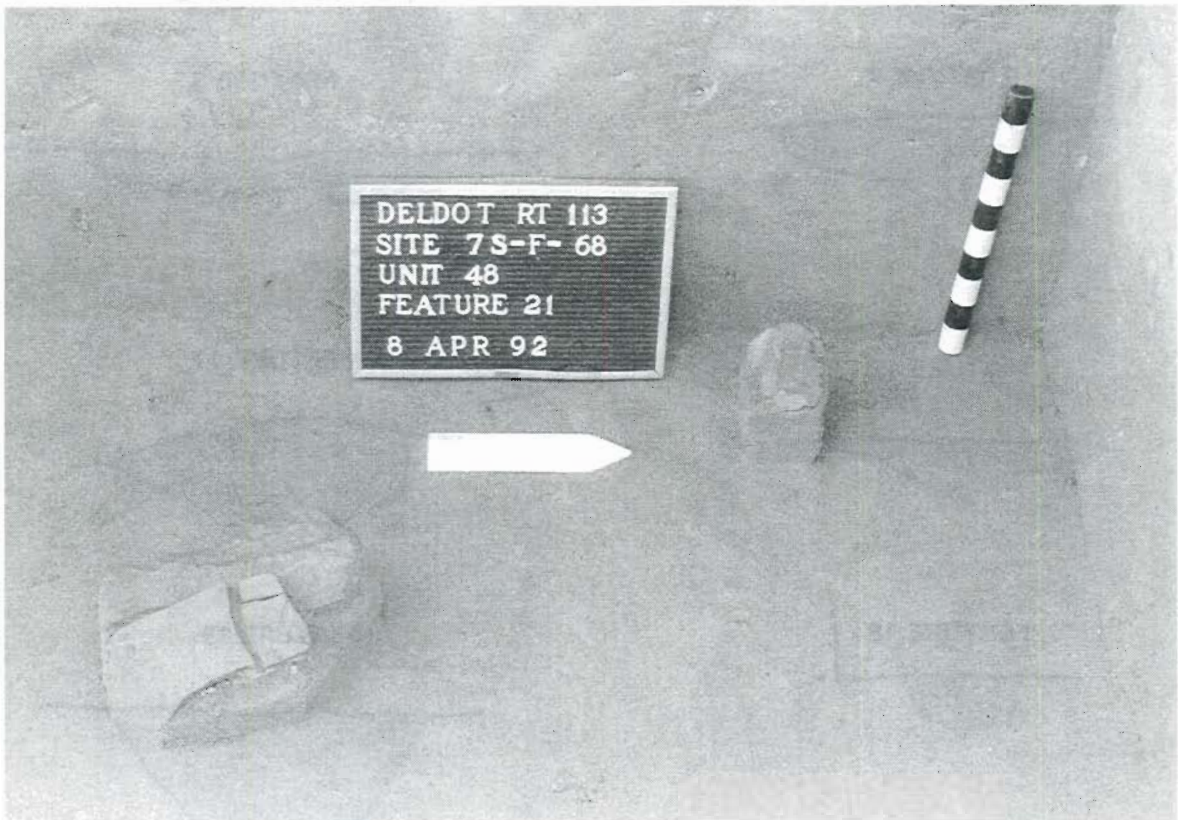


PLATE 3: Feature 21.

(Stewart 1982). None of these methods required the use of pottery, so that all could have been used by Archaic and Paleoindian populations. Throughout the Eastern Woodlands, Archaic groups brought rocks to occupation sites for use in cooking, and a variety of cooking methods may be inferred from excavated archaeological features. For example, at the Longworth-Gick Site in Jefferson County, Kentucky, the Early Archaic (corner-notched points and bifurcate-based point) features included charcoal concentrations, rock-free areas of reddened soil, areas of reddened soil with charcoal, and small fire pits (Collins et al. 1979).

Binford (1983) has presented ethnographic and excavation data indicating that hearth areas are normally the foci around which a broad range of activities are carried out in campsites. Intrasite spatial analysis (see Chapter VII) indicates that Feature 31, the FCR concentration in the South Excavation Block of Site 7S-F-68, was the focus of activities such as the rehafting of bifaces and the production of lithic tools during the Early Archaic. Interpretation of the charcoal concentrations is more problematic, as they are widely scattered throughout the site; the most straightforward interpretation is that they are informal cooking or heating areas.

B. HISTORIC FEATURES

1. *Human Burials*

Nine human burials (Features 5, 9, 15, 29, 30, 36, 38, 39, and 40) were identified and excavated during the Phase III excavations. The interments are associated with a small family cemetery believed to have been used during the late eighteenth and early nineteenth centuries. The burial features were concentrated in the northern, most elevated portion of the site. DelDOT authorized preparation of a separate report containing focusing on the cemetery, including description and interpretation of the burials (LeeDecker et al. 1995).

2. *Dog Burials*

Three of the site's features are dog burials (Features 1, 35, and 37), all of which were located in the northern

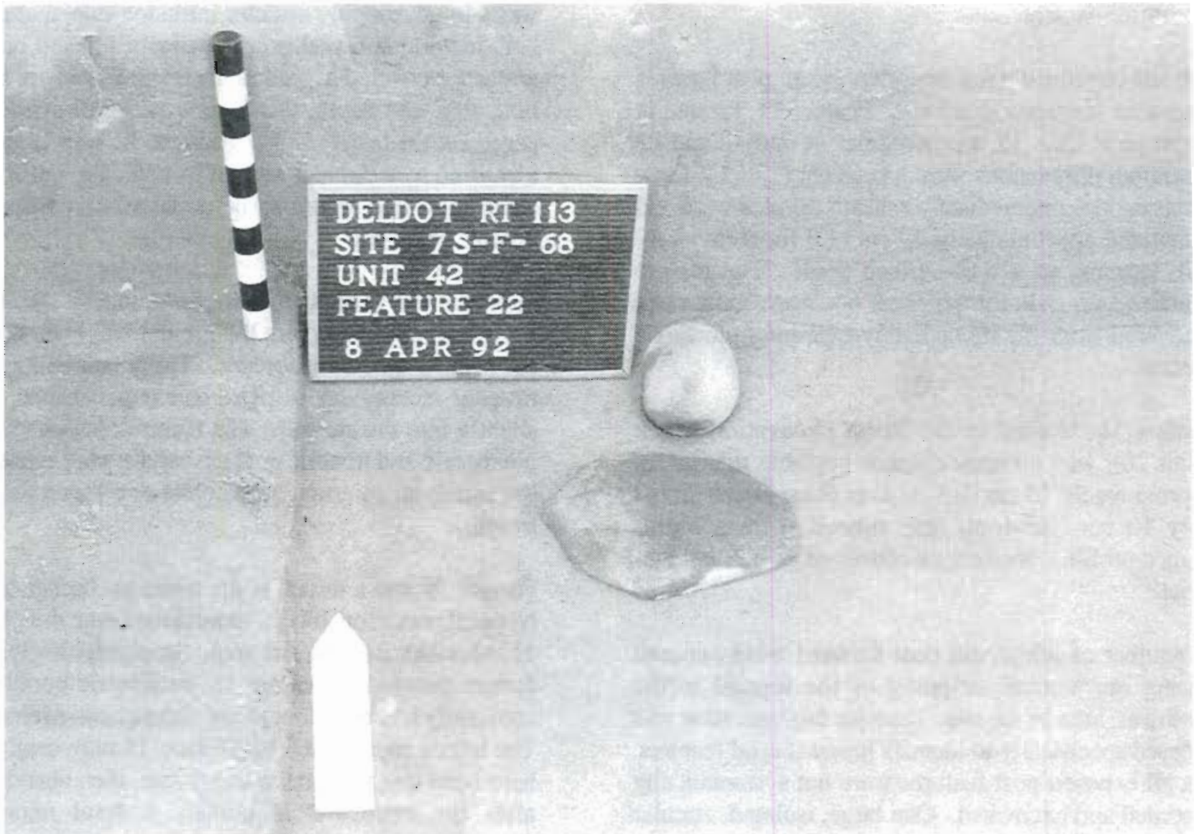


PLATE 4: Feature 22.

area of the site. Feature 1 was identified and excavated during the Phase II excavations. Features 35 and 37 were identified and excavated during the topsoil stripping operations carried out at the conclusion of the manual Phase III excavation program. Based on the condition of the skeletal material, stratigraphic relationships, and associated artifacts, all of the dog burials appear to represent modern use of the site.

Feature 1 was initially identified by the recovery of mammalian longbone from a shovel test, and it was fully excavated within Test Units 3 and 4. The Feature 1 burial had been placed in a shallow rectangular shaft that measured approximately 60-70 x 120 cm in plan, with the long axis perpendicular to Route 113. The burial pit fill contained a quartz bifurcate-based projectile point dating to the Early Archaic period, along with a mixture of the shell and gravel paving deposits associated with the automobile repair shop driveway adjacent to the site.

Feature 35 was discovered by mechanical topsoil stripping northwest of the North Excavation Block. The burial pit was oval or kidney-shaped in plan, with the long axis parallel to Route 113. The feature was initially divided into two areas based on soil color, and it penetrated the western end of Feature 36, an historic human burial. A posthole (not given a separate feature number) also intruded into Features 35 and 36. The Feature 35 burial pit contained the complete skeleton of a domestic dog, with its head at the south end of the pit. Coffin nails and wood fragments present in the Feature 35 fill seem to have originated when the dog burial (Feature 35) penetrated the historic human burial (Feature 36).

Feature 37 was a shallow burial pit that contained the complete skeleton of a domestic dog. It was identified during mechanical topsoil stripping northwest of the North Excavation Block. The burial pit was elongate and irregular and oriented east-west, with a maximum length of 107 cm (3.5 feet) and a maximum width of 25 cm (1.0 foot). The skeleton was oriented with the skull at the east end of the burial pit. The condition of the bone suggested a modern origin for the burial, but there were no artifacts associated with the feature.

3. *Post Features*

The site contained a few historic/modern post features located at scattered locations. Feature 11, located in Excavation Unit 35, was irregular in outline and its maximum dimensions were 44x68 cm (1.4x2.2 feet). It was exposed immediately beneath the plowzone and penetrated approximately 40 cm (1.3 foot) into subsoil, tapering to a well-defined point. The feature contained no cultural material; however, nails were recovered from the immediately overlying plowzone horizon.

Feature 16, located in the North Excavation Block (Unit 28), was a small, circular posthole measuring approximately 15 cm (0.5-foot) in plan. It penetrated only 10 cm (0.3-foot) into subsoil, with a basin-shaped profile. The feature contained no cultural material.

A number of additional post features were exposed during mechanical stripping of the topsoil in the northwest area of the site. Because this operation was focused specifically to identify human burial features, not all exposed post features were not systematically recorded and excavated. One large, isolated, circular post hole, Feature 41, was fully excavated in this area and it was determined to be of historic origin, based on the presence of metal fragments in the fill.

A row of three postholes were identified during excavation of Features 35 (dog burial) and 36 (human burial). The three features were roughly circular in plan and measured 21 cm (0.7 foot) to 30 cm (1.0 foot) in diameter, they were spaced approximately 61 cm (2.0 feet) apart. It is believed that these post features supported a small roadside sign associated with the automobile repair shop.

4. *Modern Disturbances/Soil Intrusions*

Four modern disturbances or intrusions were identified as features. Feature 4, located in Excavation Unit 13, was a large, roughly circular intrusion that contained both historic and prehistoric artifacts. Based on the artifacts recovered as well as the feature's general location, size, and depth, this feature was identified as a geotechnical test boring. Feature 32 was likewise identified as a circular area of mixed fills, but it was ultimately determined to be a shovel test from the Phase I fieldwork.

Feature 7 was located at the roadside edge of the North Excavation Block, where the ground had been down-cut toward the road shoulder. This disturbance was roughly rectangular in plan, and it penetrated only slightly into the subsoil. The feature contained both prehistoric and historic artifacts, and it may represent tire ruts from an errant automobile or a failed looter's trench.

Feature 34 was a trench at the northeast corner of the North Excavation block, extending from the Route 113 shoulder into the site area. Stratigraphically, this feature penetrated Feature 15, an historic burial that apparently had been looted and subsequently reburied. The trench represented by Feature 15 may originally have been dug to install a utility line, then abandoned after the exposure of human skeletal material. However, there was no utility line within the trench, and it is possible that the trench was excavated by looters.

C. NONCULTURAL FEATURES

A number of soil anomalies were excavated as features but were ultimately determined to be of noncultural origin such as rodent burrows or tree root disturbances. These include Features 3, 6, 10, 13, 14, 27, and 28.

VI

SITE FORMATION PROCESSES AND PREHISTORIC COMPONENTS

The principal goal of this chapter is to establish cultural units for interpretation of the prehistoric use of the site. Because past human behavior cannot be directly observed, it must be examined through its tangible byproducts, artifacts. Inferences about past behavior are drawn from patterns observed in the spatial and temporal arrangement of artifacts. However, the arrangement of artifacts within an archaeological site is not always a direct reflection of past human behavior; both natural and cultural processes, over time, reshape or alter a site's archaeological record (Schiffer 1987). Consequently, the identification and evaluation of site formation processes must precede the definition of cultural or stratigraphic units, activity areas, and other patterning in the archaeological record that presumably reflects cultural behavior.

The typological evidence for establishing individual prehistoric components or occupations is discussed in Section A, and site formation processes are addressed in Section B. This latter discussion considers the natural processes of soil development and landscape evolution, the relationship of the prehistoric deposits and features to specific pedological contexts, and the historical and recent human activities that have modified the site's prehistoric archaeological record. The final section in this chapter (Section C) combines the above information in an attempt to define meaningful analytical units with which to investigate past human behavior as evidenced at Site 7S-F-68.

A. SITE FORMATION PROCESSES

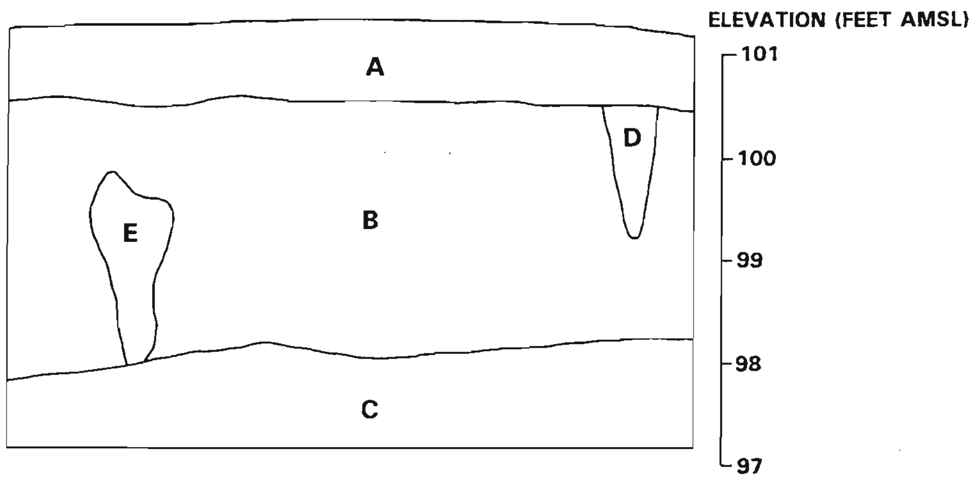
This section describes the natural and cultural formation processes that shaped the site's archaeological record. Identification of site formation processes must precede the definition of cultural or stratigraphic units, activity areas, or other patterning in the archaeological record that presumably reflects cultural behavior. The natural processes of soil development and landscape formation are discussed first, focusing on the pedological contexts which contained the site's archaeological deposits. This is followed by a general discussion of the prehistoric deposits and features, particularly as they relate to the pedological contexts. Historical and recent formation processes that have modified the archaeological record are discussed at the end of this chapter.

Three principal strata (A, B, and C) were defined during excavation. These stratigraphic designations provided a consistent field terminology for use during testing and data recovery, but they do not correspond to precisely defined pedological units. The soil stratigraphy was relatively simple, consisting of a plowzone (Ap-horizon) that overlay a weathered subsoil (Strata B and C). The soils consisted primarily of fine sands, with some mottling and argillic development visible in the lowermost levels. In the most elevated area of the site, the A-horizon was severely truncated, while the downslope area exhibited a much more massive organic surface soil. The soil profile of Excavation Unit 35 portrays the typical stratigraphy for the northern, more elevated portion of the site, while the profile for Test Unit 7 illustrates the typical stratigraphy for the southern, downslope area of the site, adjacent to the wetland (Figure 8). The plowzone, designated Stratum A, generally extended 25-30 cm below the extant surface, and it was typically described as a dark brown loamy sand. Strata B and C were yellowish brown sands, distinguished by a slightly paler color and a higher silt and clay content in Stratum C.

Wagner's pedological and geomorphological analysis of the site (see Chapter III) indicates that the site occupies a dunal landscape form. Dunal landscape forms are fairly common throughout southern Delaware, and they are often located at the margins of large swampy areas (Wagner 1992). The particle size analysis strongly supported the dunal origin of the site's landscape setting, and the profiles were dominated by fine and medium sands which are readily borne by wind. Throughout most of the site, only slight soil differences were apparent with depth, but a finer-textured substratum probably underlies the entire site area. This sandy clay loam substratum appears to have been the basal deposit upon which the aeolian sands were deposited during the Pleistocene (Wagner 1992).

Sandy soils typically display weak soil development, and they are quite susceptible to vegetative denudation, reworking, and erosion. Natural processes such as animal burrowing and tree fall also contribute significantly to mixing and reworking in sandy soils. Although it is difficult to interpret weathering and horizonation in sandy soils, the particle size distribution suggests two sequences of deposition and weathering, which may correlate to a period of soil formation during the early Holocene, followed by a later soil formation episode during a more recent xeric in

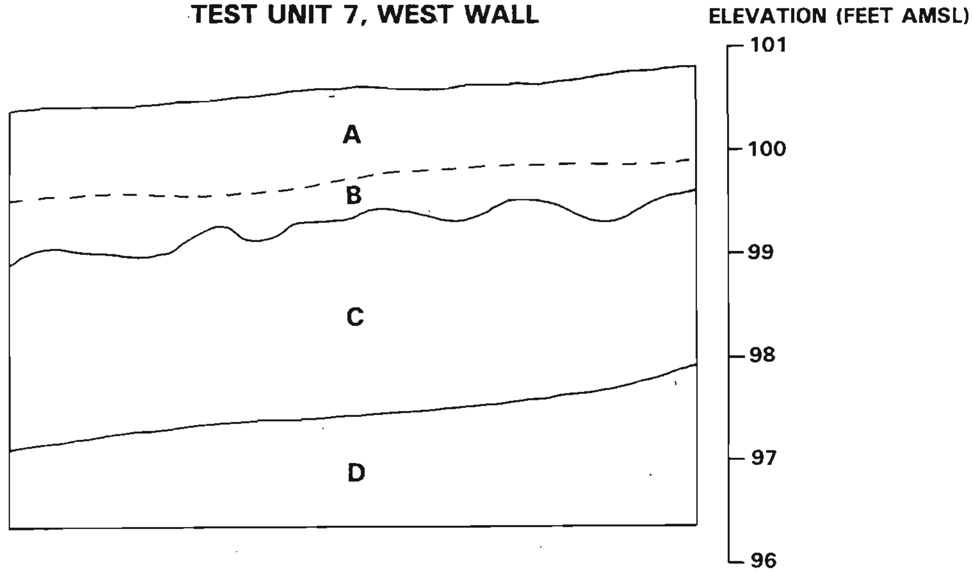
EXCAVATION UNIT 35, WEST WALL



LEGEND

- A YELLOWISH BROWN (10YR 5/4) LOAMY SAND
- B YELLOWISH BROWN (10YR 5/6) SAND GRADING INTO MOTTLED YELLOWISH BROWN (10YR 5/4), BROWNISH YELLOW (10YR 6/6), VERY PALE BROWN (10YR 7/4), LIGHT OLIVE BROWN (2.5Y 5/6), AND OLIVE YELLOW (2.5Y 6/6) SAND
- C COMPACT MOTTLED LIGHT YELLOWISH BROWN (10YR 6/4), VERY PALE BROWN (10YR 7/4), WHITE (10YR 8/2), AND BROWNISH YELLOW (10YR 6/8) SAND WITH IRON CONCRETIONS
- D TAPROOT STAIN: YELLOWISH BROWN (10YR 5/4) TO LIGHT YELLOWISH BROWN (10YR 6/4) SAND
- E WHITE (10YR 8/2) SAND

TEST UNIT 7, WEST WALL



LEGEND

- A DARK BROWN (10YR 3/3) LOAMY SAND
- B MOTTLED DARK YELLOWISH BROWN (10YR 3/4) LOAMY SAND
- C YELLOWISH BROWN (10YR 5/6) SAND
- D MOTTLED BROWNISH YELLOW (10YR 6/8) AND LIGHT GRAY (10YR 7/2) SAND

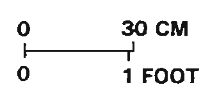


FIGURE 8: Representative Soil Profiles

terval (Wagner 1992). Although evidence of two distinct weathering episodes was not apparent at all sampling locations, the presence of strongly developed argillic horizons suggests that the landscape has remained relatively stable since the late Pleistocene.

The absence of clearcut lithological discontinuities in the stratigraphic profiles would be most consistent with a gradual, rather than episodic, introduction of new material. Moreover, a factor that would have accelerated the integration of new material into the existing soils is the sandy texture of the local soil. The pedological analysis did not indicate any lithological discontinuities, which suggests that artifact burial was primarily accomplished either through very localized reworking of the site soils or through the introduction of new materials comparable to those already on the site. Accretion of the landscape surface would be most readily attributed to the introduction of new material, most likely by aeolian activity. The homogeneous texture of the surficial soils would be consistent with accretion by introduction of new material, but only if introduced at rates sufficiently gradual to disguise different materials through the blending action of pedoturbation processes (Wagner 1990). The accumulation of roughly one meter of soil over a period of 10,000 years, an average rate of 1 cm per century, should be considered gradual. Experimental studies have demonstrated that sandy soils are much more readily "homogenized" than more finely textured soils (silts and clays) as a result of common processes such as animal burrowing, trampling, root growth, tree fall, and freeze-thaw cycles (Wood and Johnson 1978). Some downward movement of artifacts within the soil profile would be attributable to these pedoturbation processes, and this would account for the declining recovery of cultural material in the lowermost levels.

Based on typological evidence, prehistoric occupation of the site is considered to span the rather lengthy period from circa 9000 BC to 1600 BC, representing the Paleoindian through the Late Woodland periods. Given the sandy soils and the relatively shallow overall depth of deposits, it was expected that some mixing of deposits associated with various occupational episodes had occurred; nonetheless, preliminary analysis indicated that the deposits retained a measurable degree of temporal stratification.

Prehistoric artifacts were recovered from contexts ranging from the surface to a maximum depth of 1.2 meters below the extant ground surface. Distribution plots (Figure 9) indicate that nearly 90 percent of the prehistoric material was recovered from Levels 1-6 (plowzone and the first five subsoil levels). There was a sharp drop in the frequencies of recovered material below Level 6, and Levels 10-13 yielded a combined total of less than one percent of the total prehistoric assemblage. The plowzone was excavated as a single level (Level 1), and although it was equivalent in volume to two or three 10-cm subsoil levels, the amount of prehistoric material it contained was roughly equivalent to that of each of the three immediately underlying subsoil levels (Levels 2-4).

The prehistoric features identified at the site originated at depths ranging from 17 to 107 cm below the surface, and the depths from the modern ground surface to the top of the prehistoric features ranged from 10 to 90 cm, as shown in Figure 10. The burial of prehistoric features and deposits within the site must be attributed to some mechanism, either natural or cultural. For the most part, the archaeological features and deposits appear to be representative of material deposited on an occupation surface, and their burial would be attributable to natural processes.

The radiocarbon dates from the site reflect the lengthy period of site occupation, and they are consistent with use of the site from the Early Archaic through the Late Woodland/European Contact periods. Radiocarbon dates were obtained from charcoal samples from eight contexts (Figure 11). The contexts of the dated samples suggest that the deposits exhibit stratigraphic order, i.e., the oldest materials are in deep subsoil contexts, and the most recent occur in surface and near-surface horizons. The oldest date (7560 $\pm$ 340 years BP; Beta-56049) was obtained from charcoal recovered from Level 10 of Unit 45, while the most recent date (310 $\pm$ 80 years BP; Beta-56048) was obtained from Feature 20, a large charcoal concentration confined to the base of the A-horizon in Unit 47. The remaining six dates, obtained from various feature and level contexts within Levels 2-5, all fall between 1000 and 3000 years BP, an interval which roughly corresponds to the Early and Middle Woodland periods in the traditional Middle Atlantic chronology. The rough stratigraphic ordering of the radiocarbon dates supports the interpretation of gradual introduction of new material onto the site throughout the Holocene.

Crossmending, or refitting, of artifacts provides additional information pertinent to understanding the site's formation processes. After cataloging was completed, a systematic exercise to refit lithic artifacts was carried out, and a number of crossmends were identified (Table 7). Each group of two or more items that crossmended was given a specific refit number, with a letter suffix indicating the artifact class ("B" for bifaces; "U" for unifaces; "FCR" for fire-cracked rock). The refits were classified in one of four groups based on the relationship of the contexts of the crossmended pieces, "W" indicating crossmending within the same provenience, "H" indicating

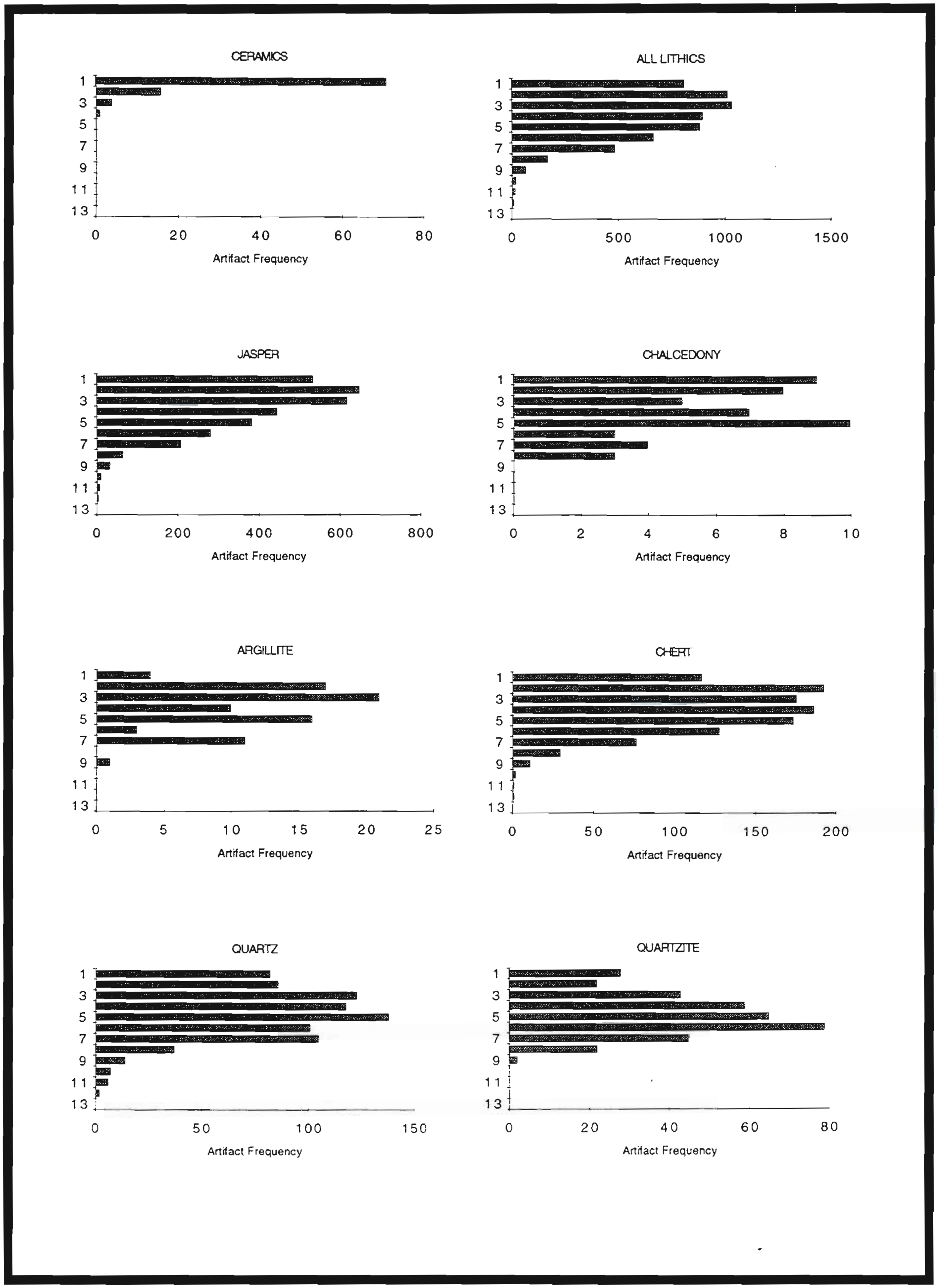
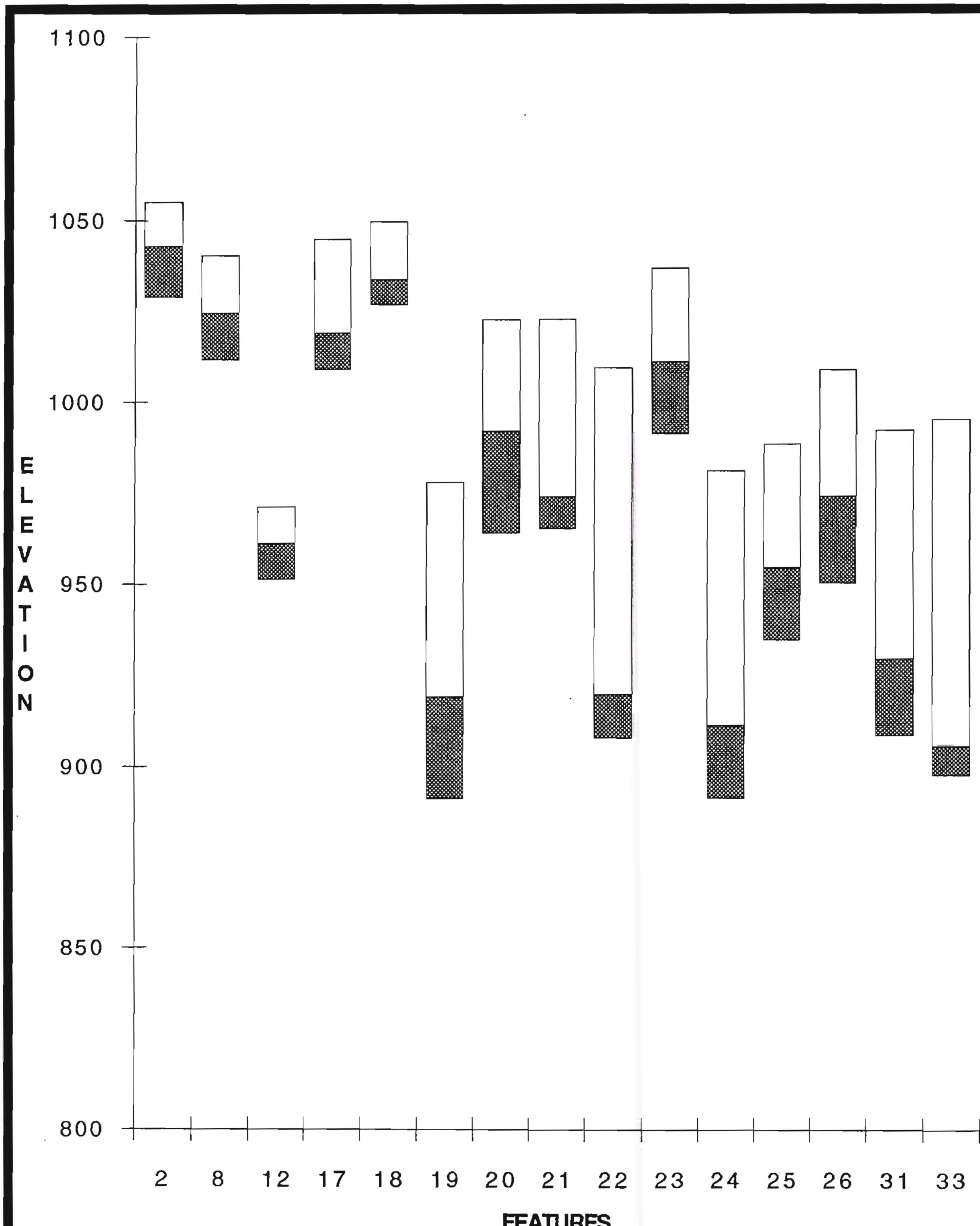


FIGURE 9: Vertical Distribution of Cultural Material



NOTE: GRAPH SHOWS ORIGIN OF FEATURES BELOW GROUND SURFACE; SHADED AREA REPRESENTS FEATURE DEPTH BELOW GROUND SURFACE; ELEVATIONS ARE EXPRESSED IN CENTIMETERS ABOVE ARBITRARY VERTICAL DATUM

FIGURE 10: Vertical Origin of Prehistoric Features

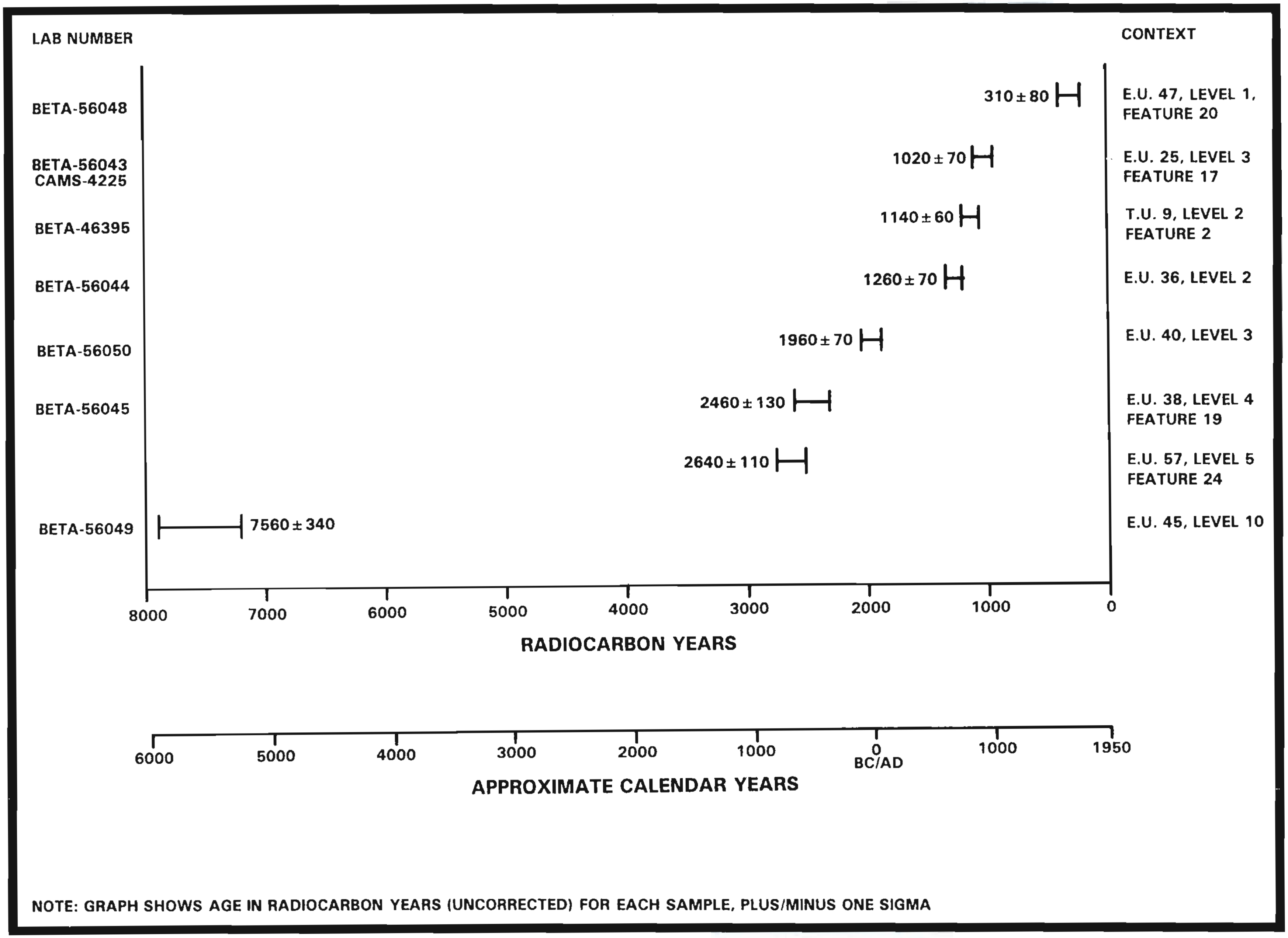


FIGURE 11: Radiocarbon Dates

TABLE 7: SUMMARY OF LITHIC REFITS

REFIT NO.		PROVENIENCES	TYPE	REMARKS
B-1	1)	EU 19, Str. B, Lv. 4 SE	O	Basal and medial projectile point fragments
	2)	Feature 39		
B-2	1)	TU 10, Str. B, Lv. 2	O	Base and tip of projectile point
	2)	E U 26, Str. B, Lv. 3, NE		
B-3	1)	EU 42, Str. B, Lv. 2, SE	V	Two basal projectile point fragments
	2)	EU 42, Str. B, Lv. 6, NW		
B-4	1)	TU 1, Str. B, Lv. 6	O	Base and tip of projectile point
	2)	EU 42, Str. B, Lv. 7, NE		
U-1	1)	EU 18, Str. B, Lv. 3, SW	O	Two fragments of sidescraper
	2)	EU 21, Str. B, wall collapse		
FCR-1	1)	TU 1, Str. B, Lv. 4	O	After crossmending, hammerstone use and anvil use was observed on the refitted object.
	2)	TU 1, Str. B, Lv. 5		
	3)	EU 36, Str. B, Lv. 2, SE		
	4)	EU 36, Str. B, Lv. 3, SW		
	5)	EU 39, Str. B, Lv. 2, NW		
	6)	EU 39, Str. B, Lv. 4, NW		
	7)	EU 41, Str. B, Lv. 4, SW		
	8)	EU 43, Str. B, Lv. 6, SE		
	9)	EU 52, Str. B, Lv. 3, NW		
	10)	EU 52, Str. B, Lv. 4, SE		
	11)	EU 52, Feature 31 (4 pieces)		
FCR-2	1)	EU 39, Str. B, Lv. 5, SW	O	
	2)	EU 45, Str. B, Lv. 4, SE		
FCR-3	1)	TU 6, Strat C, Lv. 7	O	After crossmending, hammerstone use was observed on the refitted object.
	2)	EU 42, Strat B, Lv. 5, SE (2 pieces)		
	3)	EU 42, Str. B, Lv. 6, SE		
	4)	EU 51, Str. B, Lv. 3, SE		
	5)	EU 51, Str. B, Lv. 4, NE (2 pieces)		
	6)	EU 52, Feature 31		
	7)	EU 54, Str. B, Lv. 6, SE (2 pieces)		
FCR-5	1)	TU 9, Strat B, Lv. 3	H	
	2)	TU 9, Feature 2		
FCR-6	1)	EU 42, Str. B, Lv. 7, SE (2 pieces)	V	
	2)	EU 42, Str. B, Lv. 8, SE		
FCR-7	1)	EU 48, Feature 21 (6 pieces)	W	
FCR-8	1)	TU 9, Strat B, Lv. 4	O	
	2)	TU 10, Strat B, Lv. 2		
FCR-9	1)	EU 57, Feature 31 (6 pieces)	W	
FCR-11	1)	EU 31, Str. B, Lv. 2, NE	O	
	2)	EU 52, Str. B, Lv. 4, SW		
FCR-12	1)	EU 26, Str. B, Lv. 4, NE	O	
	2)	EU 31, Str. B, Lv. 5, NW		
FCR-13	1)	TU 12, Str. B. Lv. 4, (2 pieces)	W	
FCR-14	1)	EU 25, Str. B, Lv. 3, NE	O	
	2)	EU 27, Str. B, Lv. 2, NW		
	3)	EU 27, Str. B, Lv. 2, SW		

B: Biface; U: Uniface; FCR: Fire-cracked rock. Refits FCR-4 and FCR-10 were absorbed into other FCR refits as crossmending proceeded; W: crossmending within same provenience; H: crossmending between same level of adjacent quadrants; V: crossmending between levels of same excavation unit; O: crossmending between disparate contexts.

crossmending within the same level of adjacent quadrants, "V" indicating crossmending between different levels or strata of the same unit, and "O" indicating crossmending between other disparate contexts. Among the 17 refits, only 3 were within the same context (Type W), and only three were within the same excavation unit (Type H) or the same level of adjacent units.

The spatial patterning of crossmending artifacts may reflect segregation of activity areas, discard behavior patterns, or post-depositional activities such as cleaning of the living area or various historical processes. The small number of refits allows only a limited scope of interpretation in this regard; however, there are some important insights to be gained. The majority of refits, even those involving fragments from the same unit or adjacent excavation units, occur across different excavation levels. This overall pattern might be indicative of a general pattern of reuse of lithic material at the site during successive episodes of occupation, or it may be a product of the site's loose, sandy soils which allowed extensive vertical transmigration of artifacts after discard. The refits involving formal tools (bifaces and unifaces) show extensive mending across vertical levels, which supports the latter interpretation, because there is no evidence that these tools were reused after breakage. Altogether, there are only five refits involving formal tools, including three in the north excavation block and two in the south excavation block (Figure 12).

The 12 refits involving fire-cracked rock ranged from 2 to 14 fragments per refit. Some of the refits exhibit distinct spatial clustering but, like the formal tools, the refits infrequently occurred within the same 10-cm excavation level. The most notable exception to this general pattern was FCR-7, which involved six fragments of fire-cracked rock associated with Feature 21; this feature had a depth of only 9 cm. The majority of the fire-cracked rock refits occurred within the south excavation block. Among these, three involved Feature 31, which was defined as a cluster of fire-cracked rock in an area of reddened soil. Fire-cracked rock fragments that crossmended to Feature 31 were scattered widely throughout the South Excavation Block. The remaining two fire-cracked rock refits in the south excavation block both overlap the area encompassed by the refits that crossmend to Feature 31. Within the North Excavation Block, there appear to be distinct groupings of refits. One group involving a total of four fragments (FCR-5 and FCR-8) is confined to Test Units 9 and 10 and appears to be associated with Feature 2, a charcoal concentration. The other group involves five fragments (FCR-12 and FCR-14) that mend across the southern part of the north excavation block; these crossmends represent relatively dispersed contexts and do not involve a feature.

Certain cultural formation processes may also be identified that have had an obvious effect on the prehistoric archaeological record at Site 7S-F-68. For the most part, these processes are historical or modern activities that have displaced or removed the prehistoric deposits. The small rise occupied by the site was used as a family cemetery during the late eighteenth century (LeeDecker et al. 1995). The family cemetery contained nine interments, concentrated in the north part of the site. The burial pits associated with the cemetery penetrated well into subsoil and disturbed a substantial part of the north excavation block and adjacent area. The presence of a plowzone is the most obvious example of a modern or historical activity that has displaced the prehistoric deposits, and the site was probably placed in cultivation during the late nineteenth century, after abandonment of the cemetery. Cultivation of the A-horizon would not only have disturbed the spatial integrity of the deposits and truncated features, but it may have accelerated erosion and deflation of the site. After the acquisition of the site area as state right-of-way 1911, cultivation of the site may have been discontinued.

The U.S. Route 113 roadway defines the eastern boundary of the site, as presently configured, but it is not known how much of the site was lost during downcutting and grading for the highway. Construction of a driveway to the automobile repair shop also resulted in downcutting along the northeastern margin of the site. Other modern intrusions include various posts for roadside signs, a geological boring, and three dog burials. Given the range of historical activities that have occurred on the site, it is remarkable that archaeological contexts have been preserved in a condition that permits analysis and interpretation of the prehistoric occupation.

B. PREHISTORIC COMPONENTS

Diagnostic lithic and ceramic artifacts indicate that the site was repeatedly occupied from the Paleoindian period through the Late Woodland period, with some occupations better represented than others. The assignment of individual components to cultural periods follows traditional conventions that are used across the Eastern Woodlands, in contrast to the framework developed for Delaware by Custer (1984), which expands upon work by Gardner (1974, 1977). For example, in the Custer (1984) system, Early Archaic point types, such as Palmers and Kirks, are considered to be part of the Paleoindian period; and the Late Archaic, Early Woodland, and Middle Woodland periods are combined into one unit called "Woodland I." These larger groupings are based upon similarities that have been observed in lithic procurement and settlement patterns. There is some merit to partitioning prehistory in this manner, for it highlights certain long-term trends. But, for the purposes of this study, an attempt is made to delineate more discrete temporal units, which of course can always be combined into larger units. The following two sections provide an overview of the temporally diagnostic artifacts recovered from the site that were used to identify individual prehistoric occupations.

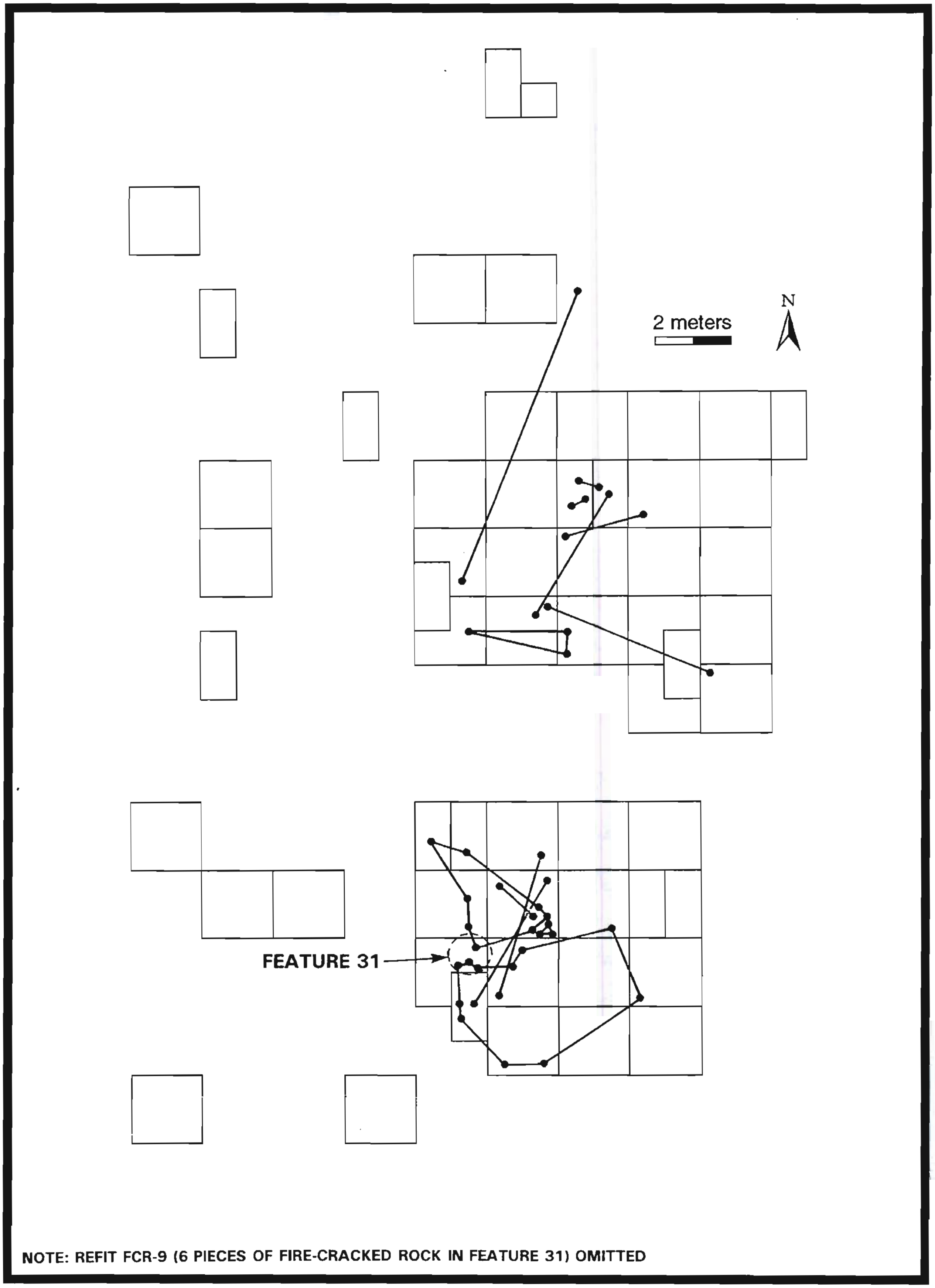


FIGURE 12: Horizontal Pattern of Refits

1. *Ceramic Assemblage*

The ceramic assemblage is made up of 109 extremely fragmentary specimens, weighing 172.2 g in total and 1.6 g on average. The majority of the sherds are shell tempered: 57 sherds have shell temper and eroded or indeterminate surfaces (72.7 g); 34 sherds have shell temper and fabric-impressed exteriors and plain interiors (77.1 g); 2 sherds have shell temper and fabric-impressed exteriors and interiors (4.4 g); 2 sherds have shell temper and plain exteriors and interiors (2.1 g); 2 sherds have sand and shell temper and cordmarked exteriors and plain interiors (6.5 g); 4 sherds have sand temper and eroded surfaces (4.5 g); 2 sherds have grit temper and eroded surfaces (1.0 g); and 5 tiny sherds have indeterminate tempers and surfaces (1.3 g). Also included in the assemblage is one fragment of fired clay (2.6 g).

The temper in all of the shell-tempered sherds has been completely removed by leaching. The only two rim sherds in the assemblage are shell tempered: one is eroded and the other is fabric impressed on its exterior. The latter has a squared lip that measures 4.6 mm in thickness. This measurement represents the minimum thickness for the fabric-impressed sherds; the mean thickness for these sherds is 5.8 mm, and maximum thickness is 6.4, which probably represents a basal sherd. Three of the best-preserved fabric-impressed sherds are shown in Plate 5.

The shell-tempered fabric-impressed sherds are so consistent in their physical characteristics that it is likely that they are derived from only one or two vessels. All of these sherds easily fit into the Townsend/Rappahannock ware types of the Late Woodland period (Robert Wall, personal communication 1993). The Late Woodland radiocarbon dates, discussed later in this chapter, undoubtedly date the site's Late Woodland component. The other shell-tempered sherds are probably part of this same component. The few sherds with sand and grit temper may represent Early or Middle Woodland components.

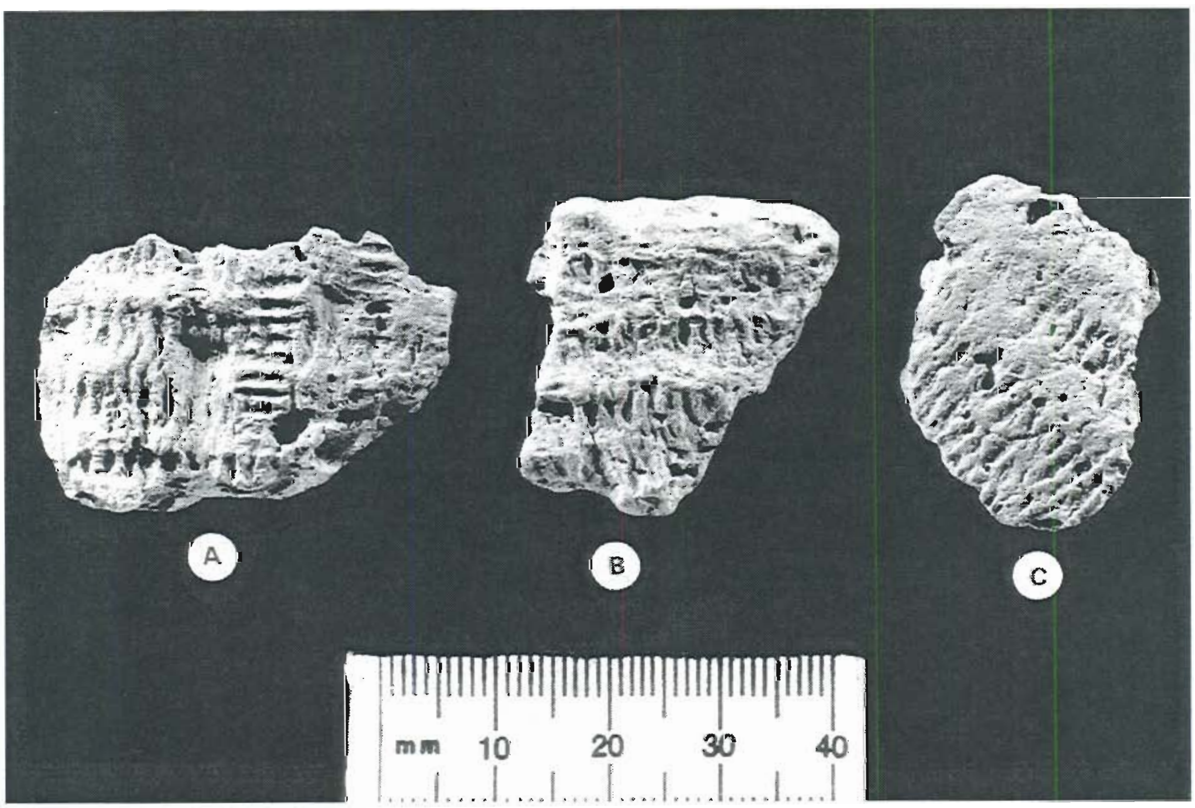


PLATE 5: Body Sherds, Fabric Impressed, Shell Temper.
A: Cat. No. 621 (Excavation Unit 29, Stratum A, Level 1); B: Cat. No. 739 (Excavation Unit 44, Stratum A, Level 1); C: Cat. No. 88 (Test Unit 7, Stratum C, Level 7).

2. *Biface Assemblage*

One hundred and twenty-five bifaces were recovered from the site: 76 are projectile points, 34 of which are assigned to cultural components. The following discussion focuses on typological data, providing preliminary interpretations and a general approximation of the sequence of occupations at the site.

A possible Paleoindian component is represented by a quartz crystal late-stage biface that appears to be a fluted-point production failure, snapped as a result of "end shock" (Crabtree 1972:60) during a fluting attempt. In Plate 6, remnants of a failed, isolated striking platform (or nipple) can clearly be seen, centered between slight projections that would have become the basal "ears" of the fluted point if it had been successfully completed. It is noteworthy that all of the fluted points from the Higgins Site in Anne Arundel County, Maryland, are manufactured from quartz (Ebright 1992). Another possibly early point is a thin, lanceolate specimen with a narrow, unground base. It is manufactured from jasper (Plate 7).

A substantial Early Archaic component (or components) is represented by 19 points, manufactured primarily from jasper and chert (Plates 8-10): 1 Palmer, 1 Kirk Corner Notched, 1 Decatur, 7 Kirk Stemmed, 6 Bifurcates, and 3 indeterminate fragments. The last are clearly portions of Early Archaic points but are too fragmentary to be assigned to point types. With its fractured or burinated base, the Decatur point is a good example of its type (Plate 8:c), which has been assigned to the Kirk Corner Notched Cluster by Justice (1987:71). It is on the extreme lower end of the size range for this point type (Justice 1987:245), but it is comparable in size to other Early Archaic points (Plates 8 and 10). Similar points, with burinated bases, are illustrated by Custer (1986b: figure 1, center) and Lowery and Custer (1990: figures 6d and 8g). The bifurcate-based points best fit the LeCroy and St. Albans types, and one of the Kirk Stemmed points (Plate 9:d) is actually typical of Coe's Kirk Serrated type (1964:70). Notable are the distal impact fractures present on one Kirk Stemmed point, two bifurcate-based points (Plate 10:a, b), and the Palmer and Decatur points (Plate 8), testifying to their use as projectiles.

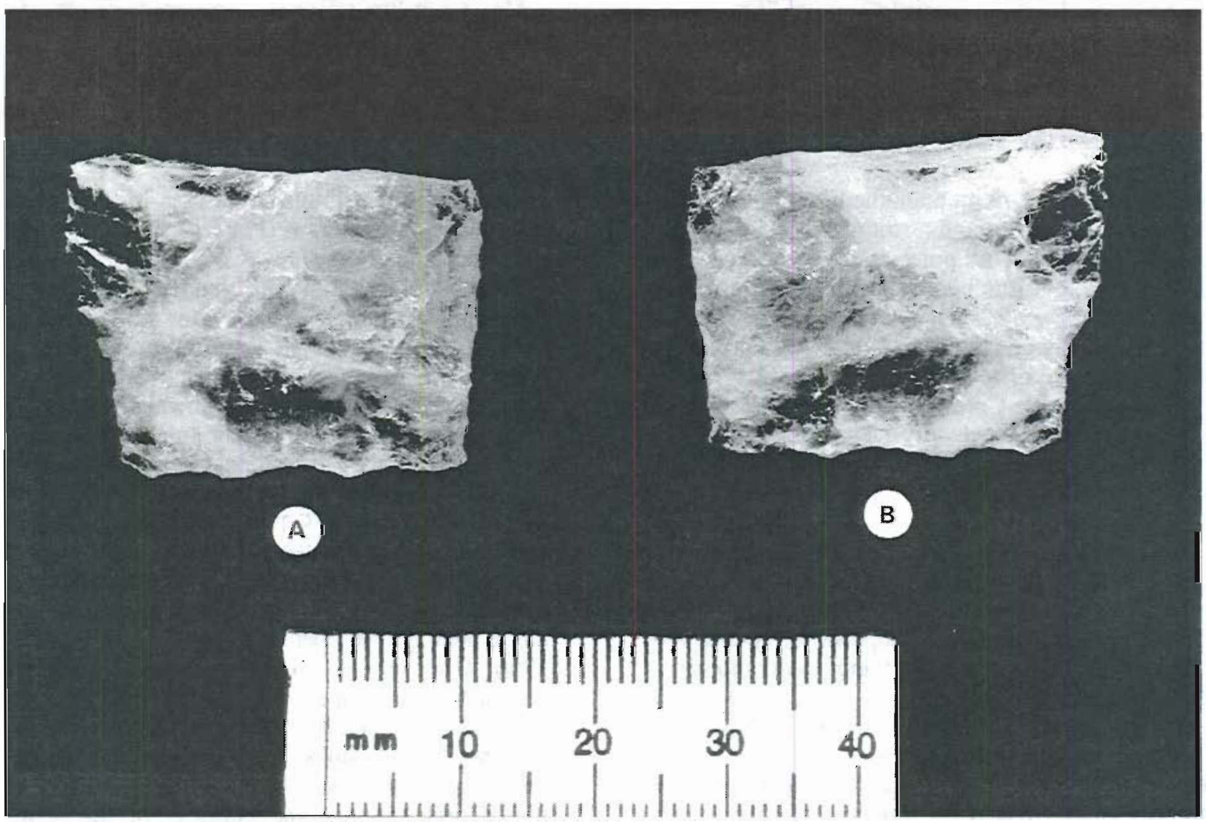


PLATE 6: Possible Fluted Point Preform, Quartz, Cat. No.380 (Excavation Unit 35, Stratum B, Level 6). A: Obverse; B: Reverse.

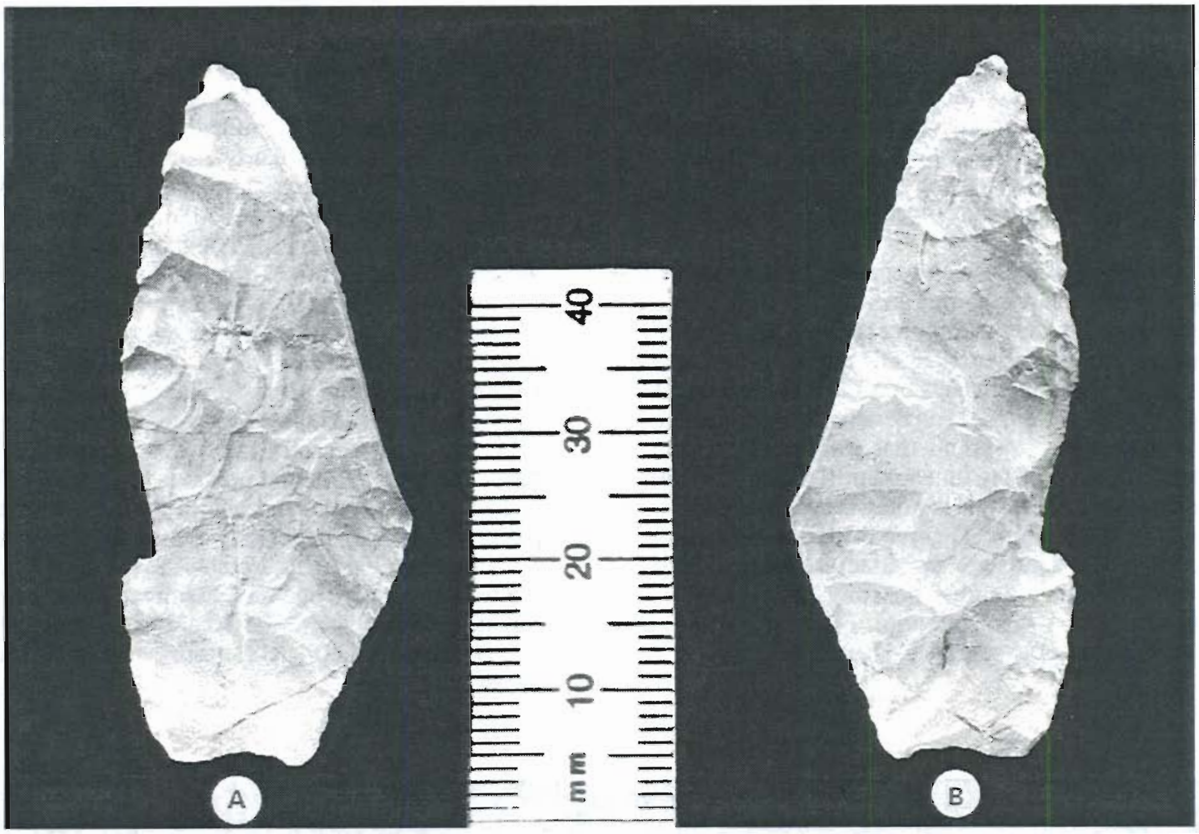


PLATE 7: Possible Late Paleoindian Lanceolate Point, Jasper, Cat. No. 129 (Surface Find). A: Obverse; B: Reverse.

The only diagnostic point manufactured from rhyolite has broad side notches and a straight base, all heavily ground (Plate 11). This point could be a Brewerton Side Notched, but it is believed to be an Otter Creek point, and following Ebright's work at the Higgins Site (1992), it is considered Middle Archaic. Like most of the rhyolite Otter Creek points at the Higgins and Indian Creek V sites (LeeDecker et al. 1991), it has been repeatedly resharpened in such a manner that its blade developed an asymmetrical outline (Ebright 1992:190).

A heterogeneous group of 12 stemmed points was initially sorted into one group that was believed to represent a Late Archaic component (or components), but upon closer inspection it appears likely that several points may represent earlier and later components (Plates 12 and 13). Even though the majority of the points have contracting stems, there are no more than two points that closely resemble each other in size and haft morphology. The points are easily separated into two groups based on raw material: seven are made from argillite, and five are made from jasper and chert.

One of the jasper points could be a Middle Archaic, Morrow Mountain point (Plate 12:a), given its broad shoulders and short stem (Coe 1964:37). A jasper and a chert point, both with slender blades and weak shoulders (Plate 12:c, d), are similar to Late Archaic/Early Woodland Teardrop points (Kraft and Blenk 1974; Mounier and Martin 1994). The serrations on the chert point are, however, atypical for teardrop points. Another jasper point (Plate 12:b) and several argillite points (Plate 13) resemble Early to Middle Woodland Rossville points (Kraft 1975; Ritchie 1971). However, because some of the argillite points are exceedingly weathered (e.g., Plate 13:c), it is difficult to be certain of their original haft morphology. The largest argillite point also resembles a heavily resharpened Koens Crispin point (Plate 13:a). The only expanding stem point in the group resembles a broadspear (Plate 14:b). Probably dating to the Late Archaic period is an untyped narrow-stemmed point, with wide shoulders and a snapped or unfinished base (Plate 14:a). In light of these typological assessments, the majority of the stemmed points probably represent Late Archaic and Early Woodland occupations.

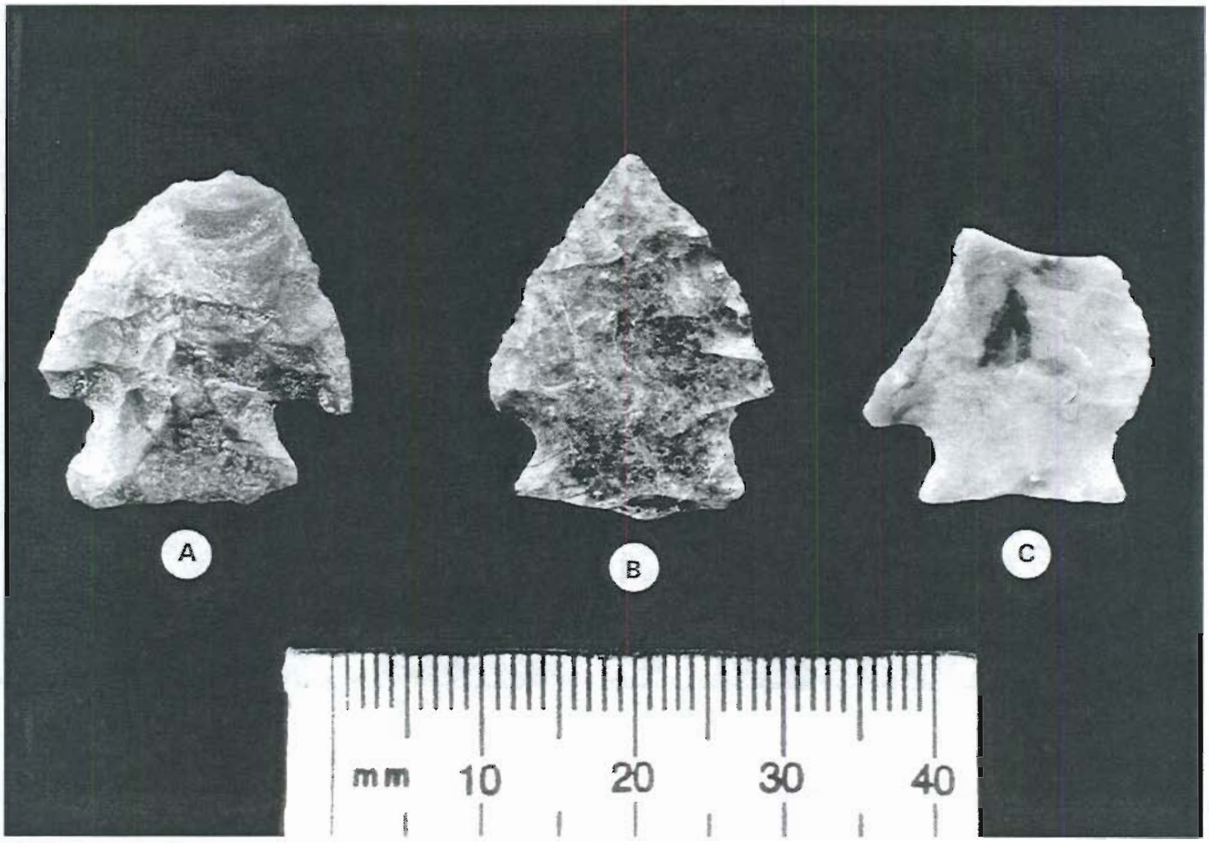


PLATE 8: Early Archaic Projectile Points. A: Palmer Point, Jasper, Cat. No. 910 (Excavation Unit 53, Stratum A, Level 1); B: Possible Small Kirk Corner Notched Point, Jasper, Cat. No. 60 (Test Unit 2, Stratum C, Level 11); C: Decatur Point, Chert, Cat. No. 893 (Excavation Unit 45, Stratum B, Level 6).

A Late Woodland component is represented by a single triangular arrowpoint manufactured from jasper (Plate 14:c). It is undoubtedly associated with the small sample of shell-tempered ceramics recovered from the site.

In sum, the stone points document a nearly continuous use of the site, with the Early Archaic and Late Archaic/Early Woodland periods witnessing the most intense use of the site (as measured by number of points). Yet, even during these periods, the diversity of point types indicates a number of separate occupations, rather than one large occupation. For example, during the Early Archaic period the Palmer, Kirk Corner Notched, and Decatur points may represent one occupation, while the bifurcate-based points and Kirk Stemmed points represent separate, slightly later occupations. The site was apparently never the locus of a substantial occupation, as a base camp or hamlet; rather, it appears to have been a preferred short-term campsite throughout prehistory.

C. ANALYTICAL UNITS

A series of analytical units (AUs) were defined as a means to examine differences in the use of the site through time. In essence, an analytical unit is a formal device to "lump" or combine deposits from discrete excavation contexts, enabling analysis to proceed according to more inclusive data sets. Various criteria may be used for construction of analytical units: pedological criteria, stratigraphic relationships, archaeological formation processes, post-depositional disturbances, deposit dates derived from typologies, artifact refit patterns or crossmending, and characteristics of the refuse assemblage such as frequency and artifact patterns (LBA 1986:129-131). All of these criteria have been used effectively; however, it is important to note that the utility of the criteria varies according to particular site conditions as well as the particular analytical goals.

Site 7S-F-68 did not contain the clearcut stratigraphy or well-defined, refuse-bearing features that would readily lend themselves for use as analytical units. Typological evidence indicates use of the site from

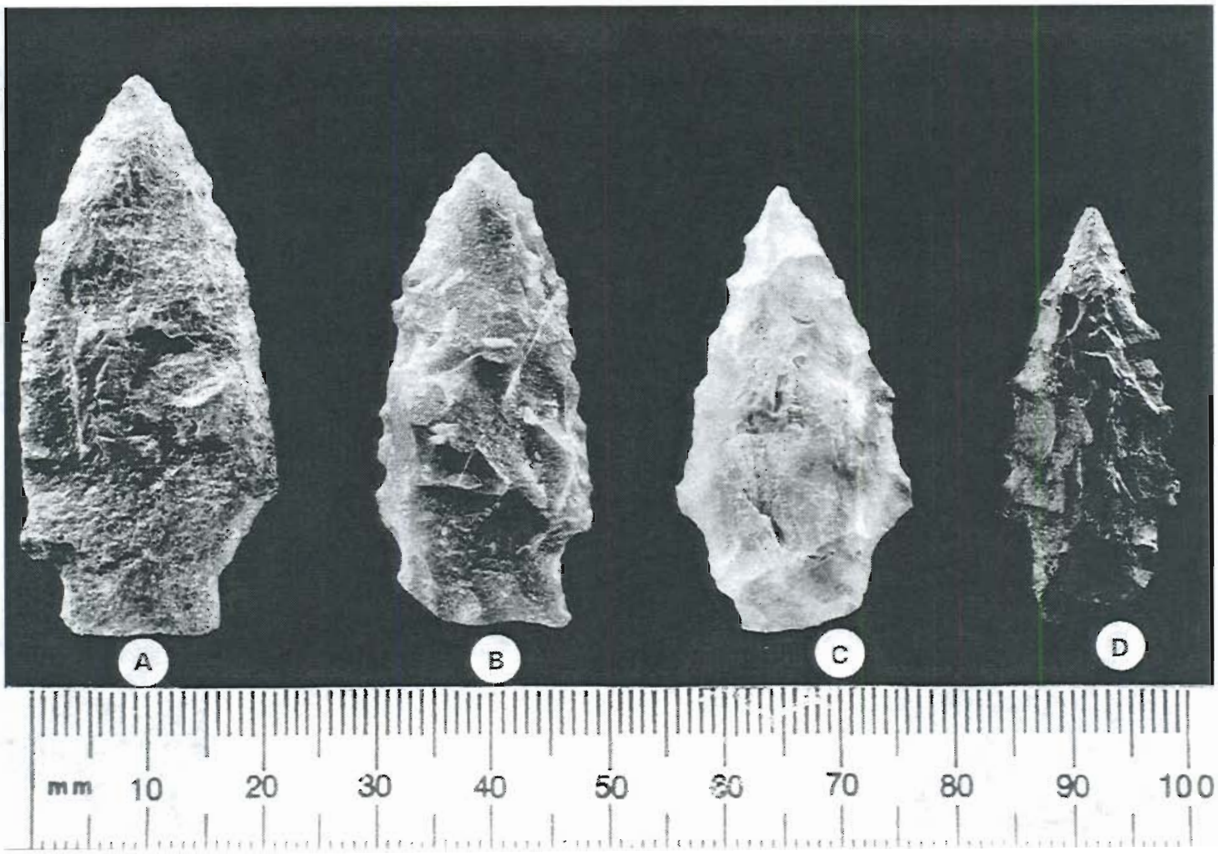


PLATE 9: Kirk Stemmed Points. A: Quartzite, Cat. No. 875 (Excavation Unit 45, Stratum B, Level 2); B: Chalcedony, Cat. No. 884 (Excavation Unit 45, Stratum B, Level 4); C: Chert, Cat. No. 874 (Excavation Unit 45, Stratum A, Level 1); D: Chert, Cat. No. 960 (Excavation Unit 46, Stratum B, Level 4).

the Paleoindian through the Late Woodland period, and the associated deposits were found in sandy, dunal landscape surface contexts that accumulated gradually during the Holocene epoch. The stratigraphic sequence observed during excavation was relatively simple, consisting of a truncated plowzone overlying a weathered subsoil. By the gradual introduction of new material through aeolian deposition, and continued use of the site throughout prehistory, the deposits were mixed to a degree that obliterated depositional planes or occupational surfaces.

Given the absence of well-defined stratigraphic units, initial analysis of the deposits focused on the distribution of material according to vertical provenience (i.e., excavation levels). As mentioned in the preceding section, the rough chronological ordering of the radiocarbon dates in the excavation levels did indicate that the site had retained a degree of stratigraphic integrity.

The vertical distribution of diagnostic artifacts also supports the conclusion that the deposits exhibit temporal stratification, although it is apparent that some mixing of deposits has occurred. Prehistoric ceramics, nearly all of which appear to be of the Late Woodland or Woodland II Townsend series, were most concentrated in plowzone and first subsoil level (see Figure 9), while lithic material exhibited a much greater vertical distribution. In addition, certain raw materials which are strongly associated with a particular cultural component exhibit a distinctive vertical patterning. For example, quartz and quartzite are strongly associated with the Paleoindian and Early Archaic components, and these materials were most concentrated in the lower excavation levels. Argillite, which is strongly associated with the Late Archaic/Early Woodland component, was more concentrated in the higher excavation levels.

The projectile point distributions (Figure 13) clearly exhibit certain anomalies, some of which may be attributable to cultural formation processes. For example, the presence of the earliest diagnostics, such as the Palmer point and the possible Paleoindian point, in surface and plowzone contexts might be explained by reuse of these tools during later periods of prehistoric site occupation or by their having been brought

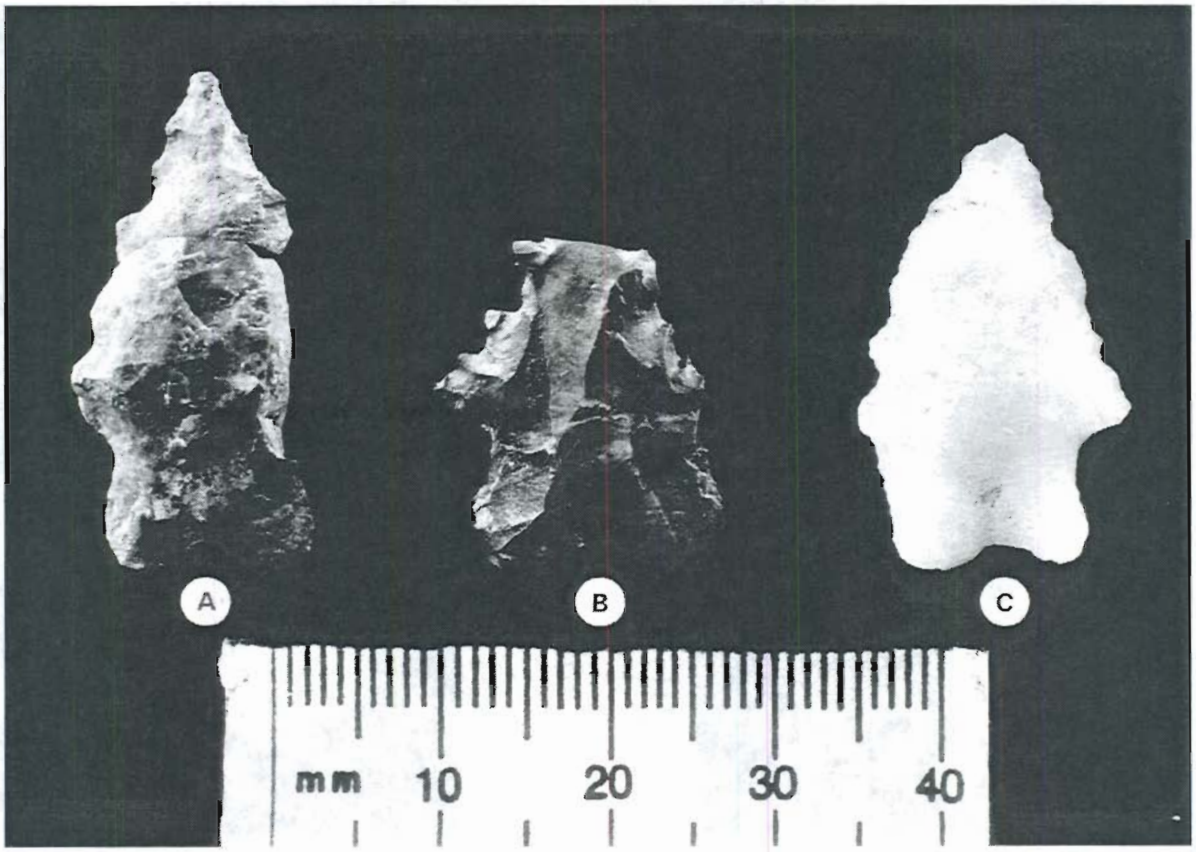


PLATE 10: Bifurcate Base Points. A: Chert, Deer Family-Level Blood Residue, Cat. No. 49/502 (Test Unit 1, Stratum B, Level 6 and Excavation Unit 42, Stratum B, Level 7); B: Jasper, Cat. No. 484/499 (Excavation Unit 42, Stratum B, Levels 2 and 6); C: Quartz, Cat. No. 73 (Test Unit 3, Feature 1).

to the surface by intrusive activities, such as the excavation of postholes, grave pits, or plowing during the historic period. The bifurcate-based points seem to represent the stratigraphically earliest group of which there is an appreciable sample size. The generalized Early Archaic and Late Archaic/Early Woodland point groups apparently occupy a stratigraphically superior position relative to the bifurcate-based points. One anomalous pattern that is not easily explained is the distribution of the Kirk points. The single Kirk Corner Notched point was recovered from Level 11, while the six Kirk Stemmed points were recovered from Level 1 (plowzone) through Level 4, and this group obviously represents a more recent stratigraphic group than the bifurcate-based points. (One Kirk Stemmed point recovered from a collapsed wall is not plotted in Figure 13). Wesler (1983) has previously pointed out that the two Kirk point types are not contemporaneous, and this fact is clearly expressed at Site 7S-F-68.

The three principal analytical units defined--Early, Middle, and Late--represent broad periods of the site's occupation. A few excavation contexts were assigned to a residual analytical unit because they could not be readily assigned to the Early, Middle or Late AU. Most of these residual contexts represented modern features or disturbances, such as the modern geological boring (Feature 4) or the historic burials. A brief discussion of the analytical units is presented below. Additional analysis focusing on the analytical units, particularly the spatial patterning within analytical units, is discussed in the following chapter.

1. *Early Analytical Unit*

The Early AU is most representative of the Early Archaic component, which was the first significant use of the site, but it contains material that may be associated with Paleoindian and Middle Archaic occupations as well. The Early AU generally includes subsoil contexts beginning with Level 4 or Level 5 and continuing to the base of excavation. In areas that exhibited significant downcutting or truncation, most of which were included in the North Excavation Block, the Early AU began with Level 4. In areas with little or no apparent landscape truncation, includ

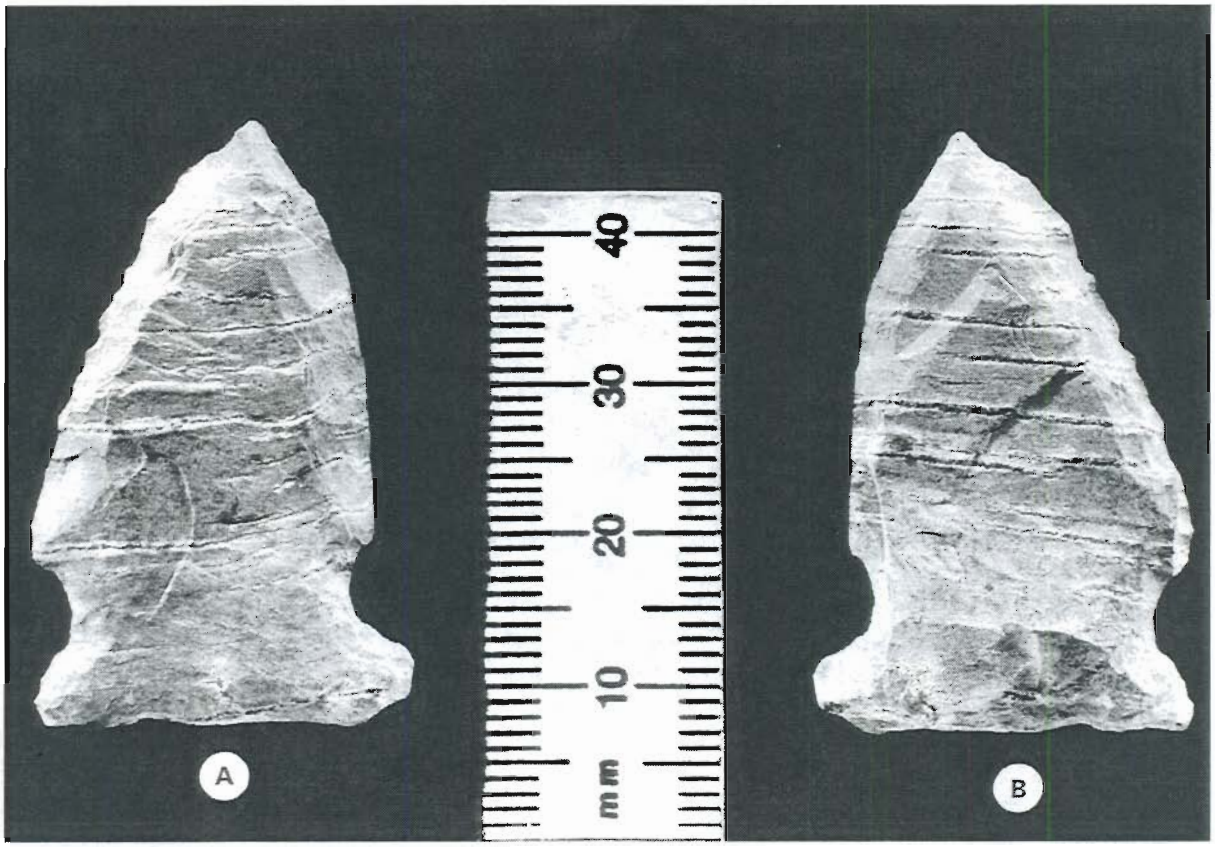


PLATE 11: Otter Creek/Brewerton Point, Deer and Rabbit Family-Level Blood residue, Cat. No. 67 (Test Unit 5, Stratum B, Level 5). A:Obverse; B: Reverse.

ing the South Excavation Block, the Early AU began with Level 5.

There is limited evidence of Paleoindian occupation--a quartz crystal late-stage biface that appears to represent a fluted-point production failure, and a crystal quartz point tip that appears to be a resharpened fluted point fragment. The surface collection from the site also contains a possible Paleoindian lanceolate point made of jasper. The fluted-point production failure was recovered from a context assigned to the Early AU, but the material from surface contexts was not assigned to one of the principal AUs. Although the site assemblage contains very little quartz crystal, this material was distributed over a small, well-defined area. With the exception of two pieces, quartz crystal debitage was recovered exclusively from a block of two units (Units 35 and 48) on the western edge of the site, and all of the quartz crystal debitage was recovered from subsoil contexts. By count, quartz crystal was most frequent in the Early AU (25 pieces), but it was also represented in the Middle AU (7 pieces). Aside from the fluted-point failure, the only other tool made of quartz crystal is a utilized flake; this item was recovered from a context in the South Excavation Block assigned to the Early AU.

The Early Archaic points were made from a variety of raw materials: jasper, chert, quartz, quartzite, and chalcedony. Among these raw materials, quartzite was used exclusively for Early Archaic points, the two examples being Kirk Stemmed points. In terms of counts by level, quartzite exhibits the lowest overall distribution by excavation levels (see Figure 9). Quartzite debitage also has a rather distinctive horizontal distribution pattern, and it is most concentrated in the South Excavation Block, centered on Feature 31 and encompassing Features 22, 25, and 28. In the units that include this quartzite concentration, the vertical distribution of quartzite matches fairly well with the Early AU, as 79 percent of the quartzite was recovered from contexts below Level 4. Vein quartz was also used exclusively for Early Archaic points, and this material has the second lowest overall vertical distribution at the site (see Figure 9).

Chert and jasper are the most common raw materials associated with Early Archaic points, but they were also used for various Late Archaic/Early Woodland and Late Woodland points. Chert and jasper have a broad vertical distribution, but their horizontal distribution shows sufficient patterning to indicate that some concentrations are probably associated with the

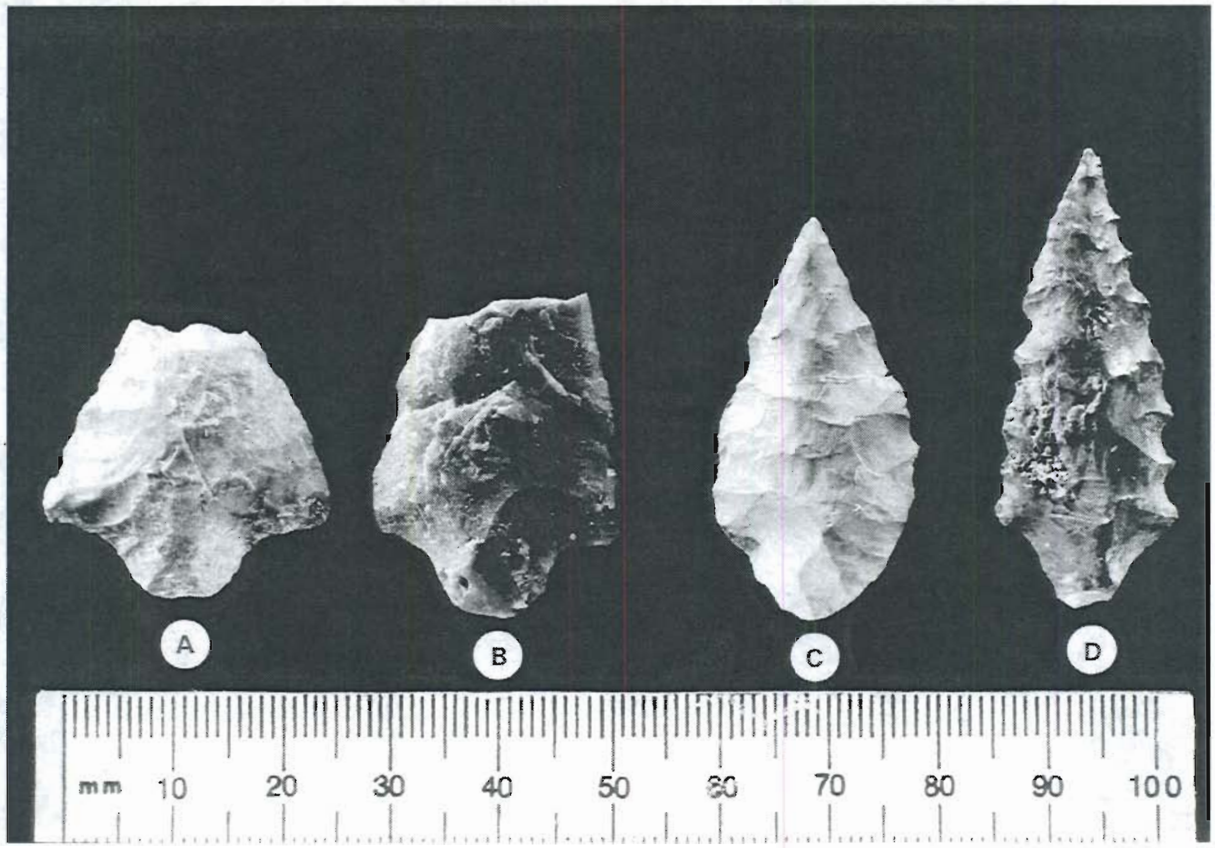


PLATE 12: Contracting Stem Points. A: Jasper, Rabbit Family-Level Blood Residue, Cat. No. 725 (Excavation Unit 49, Stratum B, Level 5); B: Jasper, Cat. No. 1 (Surface Find); C: Jasper, Bovine Family-Level Blood Residue, Cat. No. 108/425 (Test Unit 10, Stratum B, Level 2 and Excavation Unit 26, Stratum B, Level 3); D: Chert, Cat. No. 262 (Excavation Unit 22, Stratum B, Level 2).

Early Archaic occupation. The highest concentration of chert debitage was located in the subsoil levels of Unit 51, immediately adjacent to Feature 31, which was also the focus of the quartzite concentration associated with the Kirk Stemmed points. In Unit 51, chert was most concentrated in the excavation levels associated with the Early AUs, as 82 percent of the chert from this unit was recovered from Levels 4-7. There was also a concentration of jasper debitage adjacent to Feature 31, encompassing portions of Units 42, 51, and 52. In these units, most of the jasper (72%) was recovered from contexts assigned to the Early AU.

The one Early Archaic point made of chalcedony was recovered from a context assigned to the Early AU in Unit 45; this locus is also within the principal concentration of Early Archaic points that spreads across the northwestern sector of the South Excavation Block. Chalcedony debitage was not found in sufficient quantities to define major concentrations, although it is apparent that most was recovered from the northern part of the site. Units 14 and 35 had the highest chalcedony debitage counts. In Unit 14, located at the northern end of the North Excavation Block, chalcedony debitage was roughly distributed between contexts assigned to the Early and Middle AUs. In Unit 35, all of the chalcedony debitage was associated with contexts assigned to the early AU; this concentration overlaps the distribution of crystal quartz debitage believed to be associated with Paleoindian use of the site.

2. *Middle Analytical Unit*

Contexts assigned to the Middle AU consist primarily of the first two to three subsoil levels below the plowzone, which were excavated as Levels 2, 3, and 4. The inclusion of Level 4 in the Middle or the Early AU varied across the site, depending on the degree of downcutting or deflation in particular areas of the site.

The Middle AU is best considered as representative of the Late Archaic/Early Woodland occupation of the site, although contexts associated with this analytical

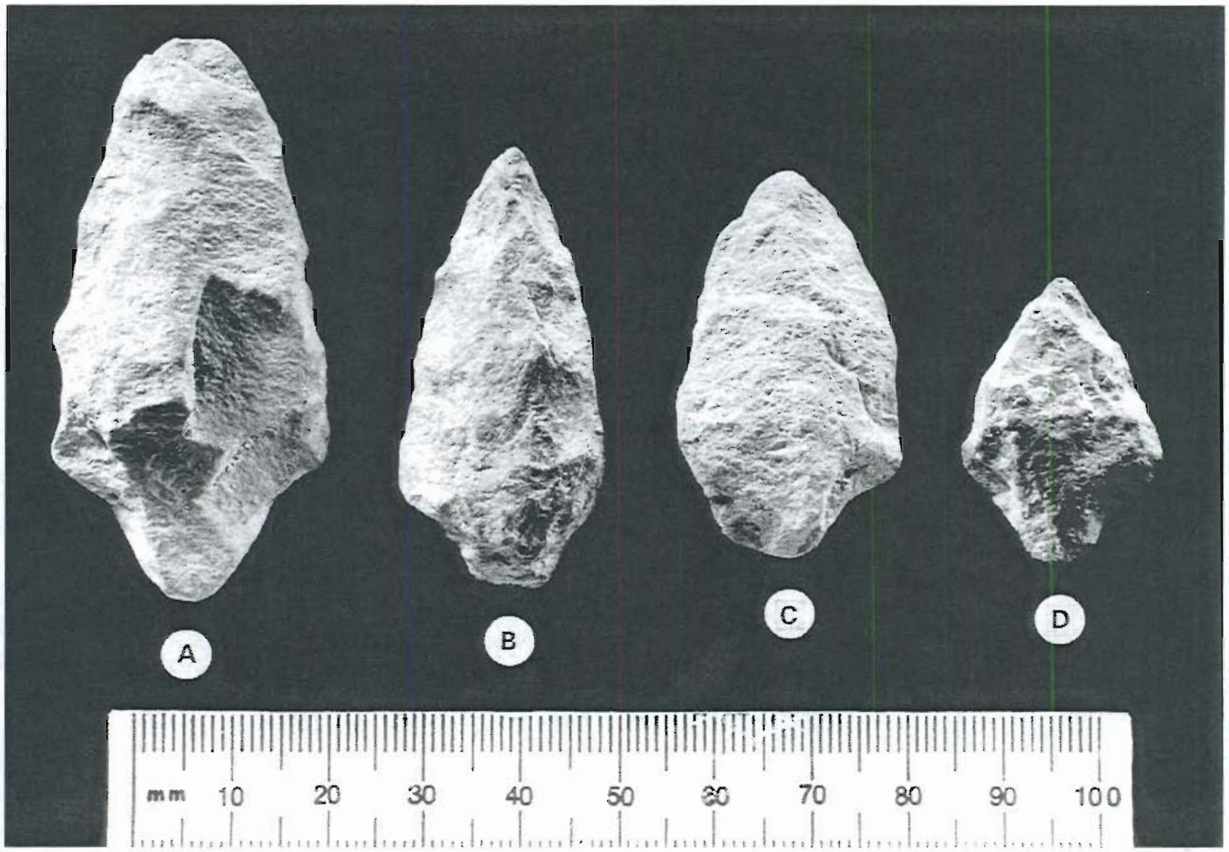


PLATE 13: Contracting Stem Points, Argillite.
A: Cat. No. 114 (Test Unit 11, Stratum A, Level 1); B: Cat. No. 109 (Test Unit 10, Stratum B, Level 3); C: Cat. No. 99 (Test Unit 9, Stratum B, Level 2); D: Cat. No. 208 (Excavation Unit 19, Stratum B, Level 4).

unit contained a mixture of earlier and later materials. While there is evidence of relatively frequent use of the site during the Early Archaic, based on the number of discarded projectiles, there is only scant evidence of Middle Archaic occupation. The one Middle Archaic diagnostic point, a side-notched rhyolite point assigned to the Otter Creek point type, was recovered from Level 5 of Unit 5, which was included in the Middle AU. Rhyolite is only sparsely represented in the site assemblage. Most of the rhyolite debitage was recovered from subsoil contexts in the North Excavation Block, but there was insufficient material to define spatial patterning.

A heterogeneous group of 12 stemmed points suggests another period of frequent use of the site during the Late Archaic to Early Woodland periods. These points were made from a variety of materials, including argillite (*N*=7), jasper (*N*=4), and chert (*N*=1). In terms of their horizontal distribution across the site, these points were scattered in a broad swath across the North Excavation Block, with single outliers found in the southern area of the site (Units 38 and 49). Seven of these points were from contexts assigned to the Middle AU, two were from Early AU contexts, and one was from a Late AU context. One jasper stemmed point recovered from a surface context was not assigned to an analytical unit.

The strong association of argillite with the Late Archaic to Early Woodland use of the site is borne out by the vertical distribution of argillite throughout the site. When total counts are viewed by excavation levels, it is apparent that argillite falls lower in the profile than ceramics but higher than other materials that are clearly associated with the Early Archaic occupations, such as quartz and quartzite (see Figure 9). Argillite is relatively scarce in the site assemblage, and none of the excavation units contained more than eight argillite items. The highest concentrations of argillite were observed in Units 15, 18, and 23 of the North Excavation Block; however, these units exhibited extensive disturbance from historic burials and downcutting associated with the driveway to the automobile repair shop. In the North Excavation Block, 60 percent of the argillite (*N*=34) were recovered from contexts assigned to the Middle AU, while in the South Excavation Block, 95 percent (*N*=19) of

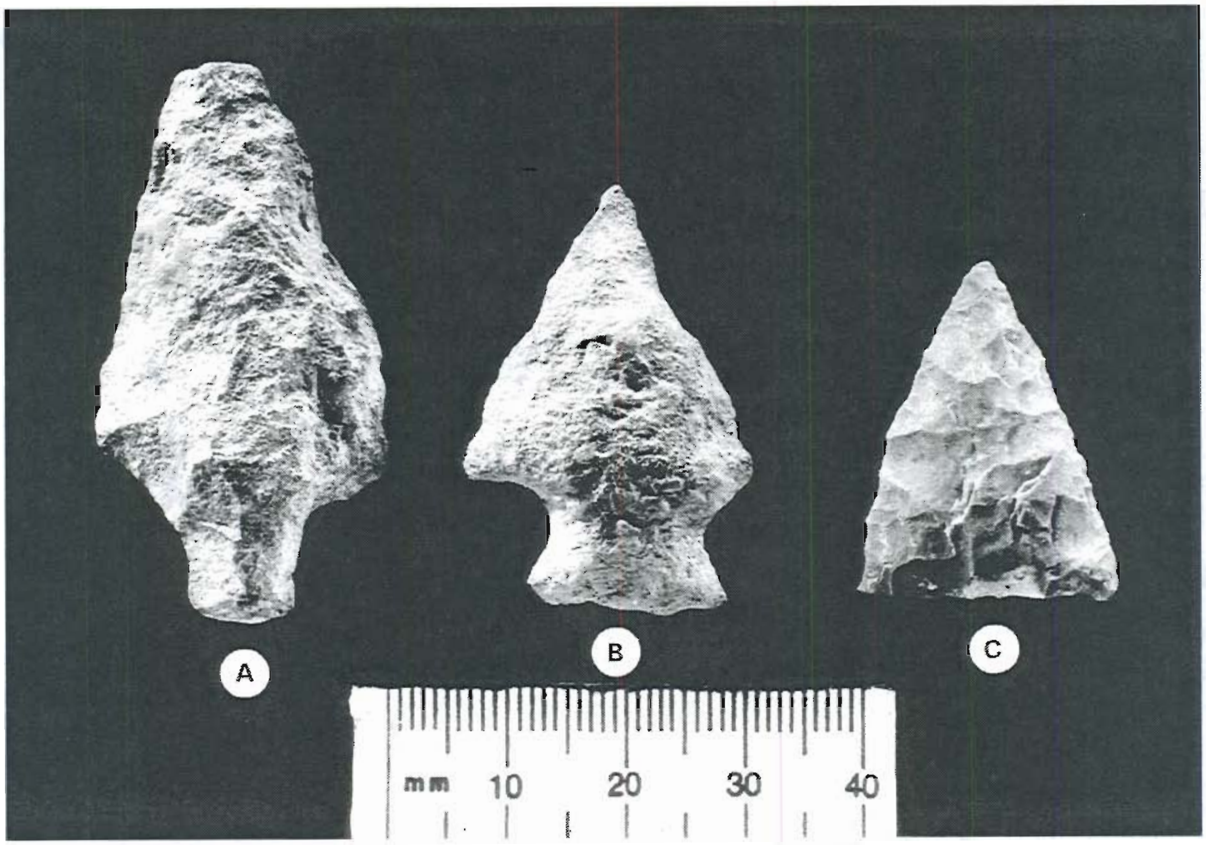


PLATE 14: Assorted Projectile Points. A: Stemmed Point, Argillite, Cat. No. 666 (Excavation Unit 24, Wall Collapse); B: Possible Triangular Broadspear Point, Argillite, Cat. No. 263 (Excavation Unit 22, Stratum B, Level 2); C: Triangular Arrow Point, Jasper, Dog Family-Level Blood Residue, Cat. No. 484 (Excavation Unit 42, Stratum B, Level 2).

the argillite was from contexts assigned to the Early AU. It is also notable that the large argillite early-stage biface and associated debitage (Feature 33) falls within the Early AU. The argillite recovered from Early AU contexts in the South Excavation Block may be a result of mixing or other post-depositional processes.

Jasper is the most common raw material in the site assemblage, and it was one of the preferred materials during each of the three major periods of site occupation. The horizontal distribution of jasper exhibits at least two major concentrations. One concentration in the South Excavation Block was adjacent to Feature 31 and associated with the Early AU. The highest concentrations were located in the northeastern sector of the North Excavation Block, particularly Units 10, 14, 15, and 18. In this area, the distribution of approximately 95 percent of the total jasper was recovered from Excavation Levels 1-4, which were assigned to the Middle and Late AUs. This area of the site had also been subjected to a number of post-depositional disturbances, including historic interments and downcutting associated with roadway and driveway construction. Another discrete jasper concentration was identified in the eastern half of Unit 23; however, the material had a wide vertical distribution in contexts assigned to the Early, Middle, and Late AUs. Unit 23 also exhibited significant post-depositional disturbances from historic burials and roadway construction. Like jasper, chert was apparently a preferred raw material throughout the site's periods of occupation. The single stemmed chert point in the assemblage was recovered from a context in Unit 22 that was assigned to the Middle AU. The horizontal distribution of chert was roughly similar to that of jasper, with the principal concentration located in the North Excavation Block (Units 14 and 18) and a secondary concentration in the South Block adjacent to Feature 31. In the North Block chert concentration 93 percent of the total chert was recovered from Levels 2-4, which were assigned to the Middle AU. The concentration of chert in the South Excavation Block (Unit 51) is apparently associated with the Early Archaic occupation, as 82 percent of the total chert from this area was recovered from contexts assigned to the Early AU.

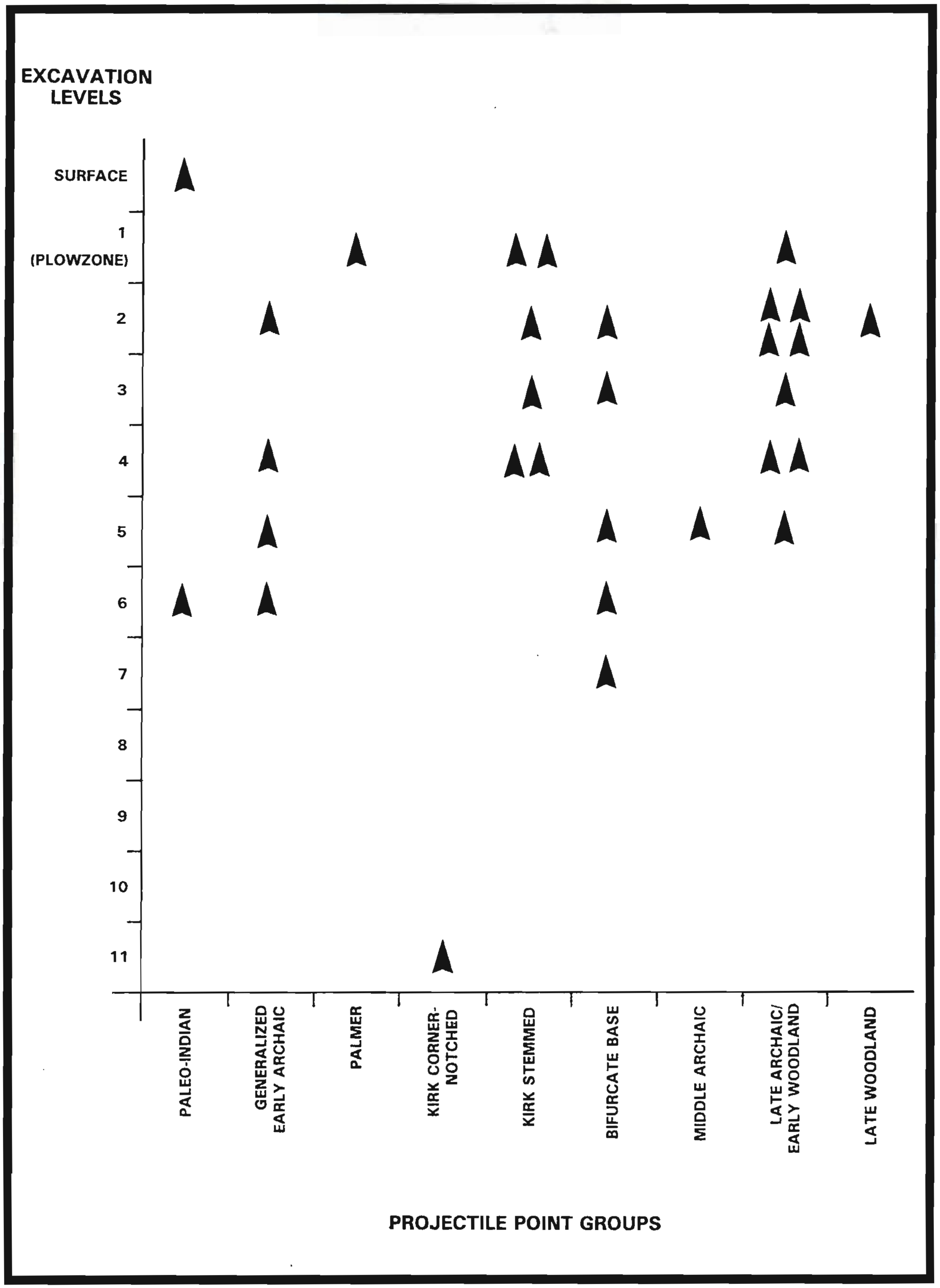


FIGURE 13: Vertical Distribution of Diagnostic Projectile Points

3. *Late Analytical Unit*

The Late AU is best considered Late Woodland, as it was defined primarily by the vertical distribution of ceramics, most of which can be identified as Townsend ware. The contexts assigned to the Late AU generally include the modern plowzone or A-horizon, except in areas that had been severely truncated, such as the northeastern margin of the site, where construction of the U.S. Route 113 roadway and the automobile repair shop driveway had truncated the landscape surface.

Throughout the entire site, the ceramics show a much higher vertical distribution than any of the lithics (see Figure 9). Ceramics were most concentrated in the plowzone, which roughly corresponds to the Late AU, but a few were recovered from subsoil contexts assigned to the Middle AU. Of the ceramics from assignable analytical units, 87 percent were associated with Late AU contexts, while the remaining 13 percent were associated with the Middle AU. The highest ceramic concentration in the plowzone (Late AU), according to sherd frequency and total weight, was identified in Unit 5. The Late Woodland projectile point in the assemblage, a jasper triangle, was recovered from Level 2 of Unit 42, a context that was assigned to the Middle AU. Jasper was a preferred lithic material throughout the site's major occupation periods, and the relatively elevated position of this raw material in the soil column attests to the frequent use of jasper during the more recent occupations. The highest concentrations of jasper are located in the North Excavation Block, particularly Units 10, 14, 15, 18, and 23. In this area most of the total jasper was recovered from Excavation Levels 1-4, which were assigned to the Middle and Late AUs. The highest concentrations of jasper debitage in the plowzone (Late AU) were identified in Units 15, 21, and 23, all of which are in the North Excavation Block.

VII

ARTIFACT ANALYSIS

A. INTRODUCTION

Archaeological investigations at Site 7S-F-68 resulted in the recovery of 6,518 prehistoric artifacts, of which 6,409 are stone tools and debris and 109 are pottery sherds and fragments of burned clay. Chipped-stone tools and debitage are the most common lithic artifacts, and they are primarily manufactured from jasper and chert (Table 8 and 9).

Temporally diagnostic artifacts, primarily bifaces (Tables 10-12), indicate that the site was repeatedly occupied from the Paleoindian through the Late Woodland period, but none of these occupations were long-term settlements. In the preceding chapter it was demonstrated that, while discrete occupational episodes are difficult to delineate, occupations can be grouped into three broad temporal units: Early (Paleoindian and Early Archaic), Middle (Late Archaic and Early Woodland), and Late (Late Woodland).

In this chapter, lithic and ceramic data are used to investigate site chronology, site function, site patterning, settlement patterns, and subsistence practices. To facilitate the investigation of these issues, artifacts from all phases of work were combined into one database. The Phase I and II artifacts were reexamined to ensure that all of the information in the database was recorded in the same fashion and at the same level of detail. This step was easily completed and permitted the largest possible database to be assembled.

B. THEORETICAL ORIENTATION AND RESEARCH ISSUES

Lithic artifacts account for more than 90 percent of the prehistoric artifacts recovered from the site and thus constitute the primary data set. Their abundance is partly attributable to their durability and chemical stability, unlike artifacts fashioned from organic materials or even artifacts manufactured from fired clay. This differential preservation of the total artifact assemblage skews interpretations by placing greater emphasis on those activities that required stone tools and generated lithic debris. It also forces researchers to glean as much information as possible from lithic assemblages.

An exception to the rule of lithic artifact stability is the rapid weathering of artifacts manufactured from argillite. Their instability must be kept in mind when comparing the quantities of different lithic materials in an assemblage. Small, thin argillite artifacts, like debitage, can often be completely erased (eroded) from archaeological deposits.

In this study, stone tools are considered byproducts of human behavior, particularly economic behavior. The economy of a society is the process by which that society provisions itself, and technology is the means by which provisioning is achieved and maintained. Technology is a key element in human adaptive strategies (White 1959).

Lithic technology--the manufacture and use of stone tools--is the primary focus of this chapter and is examined through an organizational approach, referred to as "the organization of technology" or "technological organization" (see Nelson 1991). Central to the approach is the investigation of assemblage variability, with the realization that variability is shaped by a number of interrelated factors or constraints, for example, settlement mobility, subsistence strategies, raw material availability, and site formation processes.

The organization of lithic technology is investigated by sorting lithic assemblages into a series of chipped-stone and groundstone industries (e.g., Clark 1988; Koldehoff 1987; Parry 1987). Specific industries are defined on the basis of production procedures, raw material requirements, and tool-design strategies. Industries are characterized as following an expedient or curated tool-design strategy. Expedient tools are usually informal tools that are made, used, and discarded at the same location, while curated tools are usually formalized tools that are made to be reused over an extended period, often at varying locations across the landscape (Binford 1979; Nelson 1991). Examples of curated tools are projectile points and other types of hafted bifaces; examples of expedient tools are unretouched or minimally retouched flake knives and scrapers. By design, curated tools have longer use lives than do expedient tools, and curated tools tend to have longer and more complicated life cycles because they are routinely subjected to maintenance and are often recycled (Schiffer 1972) (Figure 14).

The concepts of tool-design strategies, tool use lives, and tool life cycles are important to the investigation

TABLE 8: COUNT, WEIGHT, AND MEAN WEIGHT OF RAW MATERIAL TYPES FOR ALL CHIPPED-STONE ARTIFACT CLASSES

RAW MATERIAL TYPE	Count	Weight	Mean Weight
Jasper	3,413	1,964.9	0.6
Chert	1,187	765.7	0.6
Vein Quartz	820	1371.8	1.7
Quartzite	360	2,097.1	5.8
Argillite	88	1,791.1	20.4
Chalcedony	52	114.3	2.2
Crystal Quartz	35	18.4	0.5
Rhyolite	18	15.7	0.9
Igneous/Metamorphic	14	163.8	11.7
Ironstone	13	59.0	4.5
Indeterminate	85	42.3	0.5
TOTAL	6,085	8,404.1	1.4

Note: all weights expressed in grams.

of the research issues that were selected in accordance with the project's research design and are outlined below.

1. *Site Chronology*

Basic to any archaeological investigation is the identification of temporal/cultural components. Critical to this task is the identification of temporally diagnostic artifacts and the "mapping out" of their horizontal and vertical distribution across the site. In this chapter, and in the preceding chapter, temporally diagnostic artifacts are identified, and their site contexts examined. The methods of artifact identification are discussed below.

2. *Site Function*

Site function refers to the nature of the site: How was this particular spot on the landscape used? The key to answering this question lies in the types of activities that were conducted at the site. As mentioned earlier, not all activities required stone tools or generated lithic debris. Furthermore, not every stone tool that was used at a site was discarded at that site. Curated tools, for example, would have been used at several different sites but would have been discarded at only one (Binford 1979; Schiffer 1972, 1976). Despite these limitations, lithic assemblages furnish many insights into the activities that were conducted at a site, and also provide some measure of the intensity or duration of an individual occupation. The technological and functional analysis of lithic tools and debris supplies the main body of data needed to address this issue. These methods of analysis are discussed in the next section.

TABLE 9: FREQUENCY OF PREHISTORIC ARTIFACT CLASSES BY COUNT AND WEIGHT

ARTIFACT CLASS	Count	Weight
Bifaces	125	3,164.8
Cores	54	754.6
Cobble Tools	17	9,031.3
Debitage	5,840	4,145.0
Cracked Rock	273	6,222.6
Groundstone Tools	1	0.7
Minerals	33	64.2
Prehistoric Pottery	109	172.2
Unifaces	66	339.7
TOTAL	6,518	23,895.1

Note: all weights expressed in grams.

3. *Site Patterning*

Combining information about site formation processes, cultural components, and site activities, site patterning examines spatial relationships between temporally diagnostic artifacts and other classes of tools and debris with the aim of delineating temporally discrete activity areas or refuse disposal patterns. To aid this investigation and the investigation of site formation, several artifact classes were subjected to refitting exercises. The procedures followed during these refitting exercises have been briefly discussed in the previous chapter.

4. *Settlement Patterns*

To study settlement patterns and settlement systems (Winters 1969), contemporaneous sites or components are characterized as to their function (site type), and their distribution on the landscape is examined for patterns. Inferences that are derived from these pat

TABLE 10: SUMMARY OF BIFACIAL TOOLS

	BIFACE TYPE							
RAW MATERIAL	PROJECTILE POINT	EARLY STAGE	MIDDLE STAGE	LATE STAGE	OTHER	INDET.	TOTAL	% OF TOTAL
JASPER	41	1	2	2	.	14	60	48
CHERT	13	3	2			7	25	20
ARGILLITE	9	1	1	.	.	3	14	11
QUARTZ	5	3	1	1	.	3	13	10
QUARTZITE	3	.	.	1	2	.	6	5
CHALCEDONY	2	.	.	.	.	.	2	2
RHYOLITE	2	.	.	.	.	.	2	2
IGNEOUS/ METAMORPHIC	1	.	.	.	.	1	2	2
IRONSTONE	.	.	.	.	1	.	1	1
TOTAL	76	8	6	4	3	28	125	100%

terns most frequently pertain to strategies of resource acquisition; foremost is the acquisition of food. Lithic artifacts, as outlined above, furnish insights into site function. More importantly, if researchers identify the raw materials that were used in tool manufacture and determine the availability of these raw materials across the landscape, lithic assemblages can furnish insights into patterns of settlement mobility and land use (e.g., Ellis and Lothrop 1989). How the site may have fit into a regional settlement system is explored through the investigation of lithic procurement strategies. The methods used to identify raw materials and establish their availability are discussed later in this chapter.

5. *Subsistence Practices*

Intertwined with the issues of site function and settlement patterns is the issue of subsistence. In general terms, the diversity and intensity of certain subsistence activities can be documented by using data derived from the technological and functional analysis of the lithic assemblage. More specific information is derived from the analysis of residues found adhering to the surfaces of stone tools. Together, these lines of evidence furnish a rudimentary picture of subsistence practices, which is enhanced by the recovery of floral and faunal remains.

C. ANALYTICAL METHODS

The methods and procedures used to generate data are described in the following sections. In all cases, as artifacts were analyzed, information was recorded on analysis sheets as a series of codes, and the codes were then entered into a computer database program (R:BASE). A more complete discussion of the coding system can be found in Taylor and Koldehoff (1991).

1. *Ceramic Artifacts*

Two types of ceramic artifacts were recovered: fragments of burned clay, and pottery sherds. The fragments of burned clay were counted and weighed to the nearest tenth of a gram. The following attributes were recorded for sherds: vessel portion, temper, surface treatment, maximum thickness, count, and weight to the nearest tenth of a gram. Thickness was measured with vernier calipers but only for sherds with intact (i.e., uneroded) surfaces. Sherds were assigned to established ware types with the assistance of Dr. Robert Wall.

2. *Lithic Artifacts*

Five categories of information were derived from lithic artifacts: depositional, temporal/stylistic, functional, technological, and raw material. The methods used in the raw material and depositional (refitting) analyses are discussed with their results in other sections of this report. Residue analysis was also conducted, and the methods used are discussed with its results later in this chapter.

a) *Technological and Functional Analysis*

The analytical approach to stone-tool production and use taken in this study can be described as technomorphological; that is, artifacts were grouped into general *Classes* and then further divided into specific *Types* based upon key morphological attributes, which are linked to or indicative of particular stone-tool production (reduction) strategies. Function was inferred from morphology, as well as from use-wear. Surfaces and edges were examined for traces of use polish and damage with the unaided eye and with a 10X hand lens. Data derived from ethnoarchaeological and experimental research were relied upon in the identification and interpretation of artifact types. The

TABLE 11: SUMMARY OF PROJECTILE POINTS

POINT TYPE	RAW MATERIAL JASPER	CHERT	ARGIL-LITE	QUARTZ	QUART-ZITE	CHAL-CEDONY	RHYO-LITE	TOTALS
Paleoindian	1	.	.	.	.	.	.	1
Generalized Early Archaic	2	1	.	1	.	.	.	4
Palmer	1	.	.	.	.	.	.	1
Kirk Corner Notched	1	.	.	.	.	.	.	1
Kirk Stemmed	2	2	.	.	2	1	.	7
Bifurcate Base	2	3	.	1	.	.	.	6
Otter Creek	.	.	.	.	.	.	1	1
Late Archaic/E. Woodland	4	1	7	.	.	.	.	12
Late Woodland	1	.	.	.	.	.	.	1
TOTALS	14	7	7	2	2	1	1	34

works of Callahan (1979), Clark (1986, 1988), Crabtree (1972), Flenniken (1981), Gould (1980), and Parry (1987) were drawn upon most heavily.

A conservative approach to the identification of edge utilization and retouch was taken because a number of other factors--for example, trampling of materials on living surfaces, spontaneous retouch during flake detachment, and trowel contact, can produce similar types of damage. More precise and accurate information about tool use can be obtained if higher levels of magnification are employed (e.g., Keely 1980; Yerkes 1987), but these methods are time consuming and expensive if large numbers of artifacts are examined. However, an aggressive residue analysis program was undertaken: nearly 200 lithic artifacts were analyzed, and the results provide data not only about tool use but also about subsistence practices.

It must be noted that, for ease of analysis, only the primary or main function of artifacts with evidence of multiple functions is presented in tabular form; in the artifact inventory secondary or additional functions are listed as notes in the database. These additional functions are mentioned in the text when significant.

Organized by artifact classes, artifact types are listed below, followed by a brief definition. All types were quantified by count and by weight to the nearest tenth of a gram.

1) Debitage

Debitage includes all types of chipped-stone refuse that bear no obvious traces of having been utilized or intentionally modified. The two basic forms of debitage are flakes and shatter. Debitage was sorted into eight types, and observations on raw material and cortex were recorded. How these latter two variables were classified is discussed later.

Decortication Flakes are intact or nearly intact flakes with 50 percent or more cortex covering their dorsal surface. These are the first series of flakes detached during lithic reduction.

Early Reduction Flakes are intact or nearly intact flakes with less than 50 percent dorsal cortex, fewer than four dorsal flake scars, on the average, and irregularly shaped platforms with minimal faceting and lipping. Platform grinding is not always present. These flakes could have been detached from early- to middle-stage bifaces or from freehand or bipolar cores.

Biface Reduction Flakes are intact or nearly intact flakes with multiple overlapping dorsal flake scars and small elliptically shaped platforms with multiple facets. Platform grinding is usually present. Platforms are distinctive because they represent tiny slivers of what once was the edge of a biface. Biface reduction flakes are generated during the later stages of biface reduction and also during biface maintenance (resharpening).

Bipolar Reduction Flakes are intact or nearly intact flakes that have been struck from a bipolar core. They typically exhibit sheared cones or bulbs, closely spaced ripples, and crushed and splintered platforms. Crushing can also occur on the termination of flakes (distal end), but it is a common misconception that platforms and bulbs are present on both ends of each flake. Not all flakes that are generated during bipolar reduction are distinguishable as bipolar flakes, and large amounts of shatter are usually created.

Block Shatter are angular or blocky fragments that do not possess platforms or bulbs. Generally the result of uncontrolled fracturing along inclusions or internal fracture planes, block shatter is most frequently produced during the early reduction of cores and bifaces. Block shatter is common in bipolar reduction, and it

Table 12: Summary of Projectile Point Measurements

POINT TYPE		LENGTH	WIDTH	THICKNESS
Palmer (N=1)				
	Mean	22.5	20.7	5.7
Kirk Corner Notched (N=1)				
	Mean	24.5	19.0	4.5
Kirk Stemmed (N=7)				
	Mean	36.5	18.6	7.0
	Range	19.0 - 44.1	11.0 - 21.2	4.9 - 8.8
Bifurcate Base (N=1)				
	Mean	25.5	16.2	8.5
Otter Creek (N=1)				
	Mean	40.0	25.5	6.0
Late Archaic/Early Woodland (N=8)				
	Mean	41.9	22.1	8.1
	Range	30.3 - 58.5	16.8 - 28.5	6.9 - 11.7
Late Woodland (N=1)				
	Mean	28.9	22.1	3.7

Note: measurements expressed in millimeters.

is equivalent to "primary shatter" (Binford and Quimby 1963).

Flake Shatter are small, flat fragments or splinters that lack platforms, bulbs, and other obvious flake attributes. Flake shatter is generated throughout a reduction sequence but is most common in later stages. It is a common byproduct of bipolar reduction, and it is equivalent to "secondary shatter" (Binford and Quimby 1963). Trampling of debitage on living surfaces also generates flake shatter, while thermal fracturing produces both flake and block shatter.

Flake Fragments are sections of flakes that are too fragmentary to be assigned to a particular flake type. Typical specimens are medial and distal fragments of flakes.

Indeterminate Flakes are flakes that cannot be assigned to a specific type because their surfaces have been severely damaged (e.g., pot lidding) or eroded (e.g., argillite debitage).

2) Cores

Cores are cobbles or blocks of raw material that have had one or more flakes detached, but they have not been shaped into tools or used extensively for tasks other than being nuclei from which flakes have been struck. Cores come in various shapes and sizes, depending upon their degree of reduction and the methods of reduction that were applied. Three core types were identified, and variables recorded include raw material and cortex. If evidence of use-wear was detected, this information was entered into the database as free-form text.

Freehand Cores are blocks or cobbles that have had flakes detached in multiple directions by holding the core in one hand and striking it with a hammerstone held in the other (Crabtree 1972). This procedure generates flakes that can be used as is for expedient tools or can be worked into formalized tools. Freehand percussion cores come in various shapes and sizes, depending upon the raw material form and the degree of reduction.

Bipolar Cores are cobbles or other pieces of raw material (e.g., broken tools and debitage) that have had flakes detached by direct hard-hammer percussion on an anvil: the core is placed on the anvil and struck vertically with a hammerstone (Crabtree 1972). Cores typically assume a tabular shape, exhibit heavy crushing and battering, and have flake scars that tend to run between areas of crushing and battering. Bipolar cores are normally smaller than freehand cores because bipolar reduction is a technique for maximizing available raw materials. Most flakes that are detached are only suitable for expedient flake tools. Bipolar reduction can also be used to recycle tools or sizable pieces of debitage into usable flakes. Bipolar cores could also have been used as wedges (see Flenniken 1981; Hayden 1980), but most of the specimens in the assemblage appear to be cores rather than wedges.

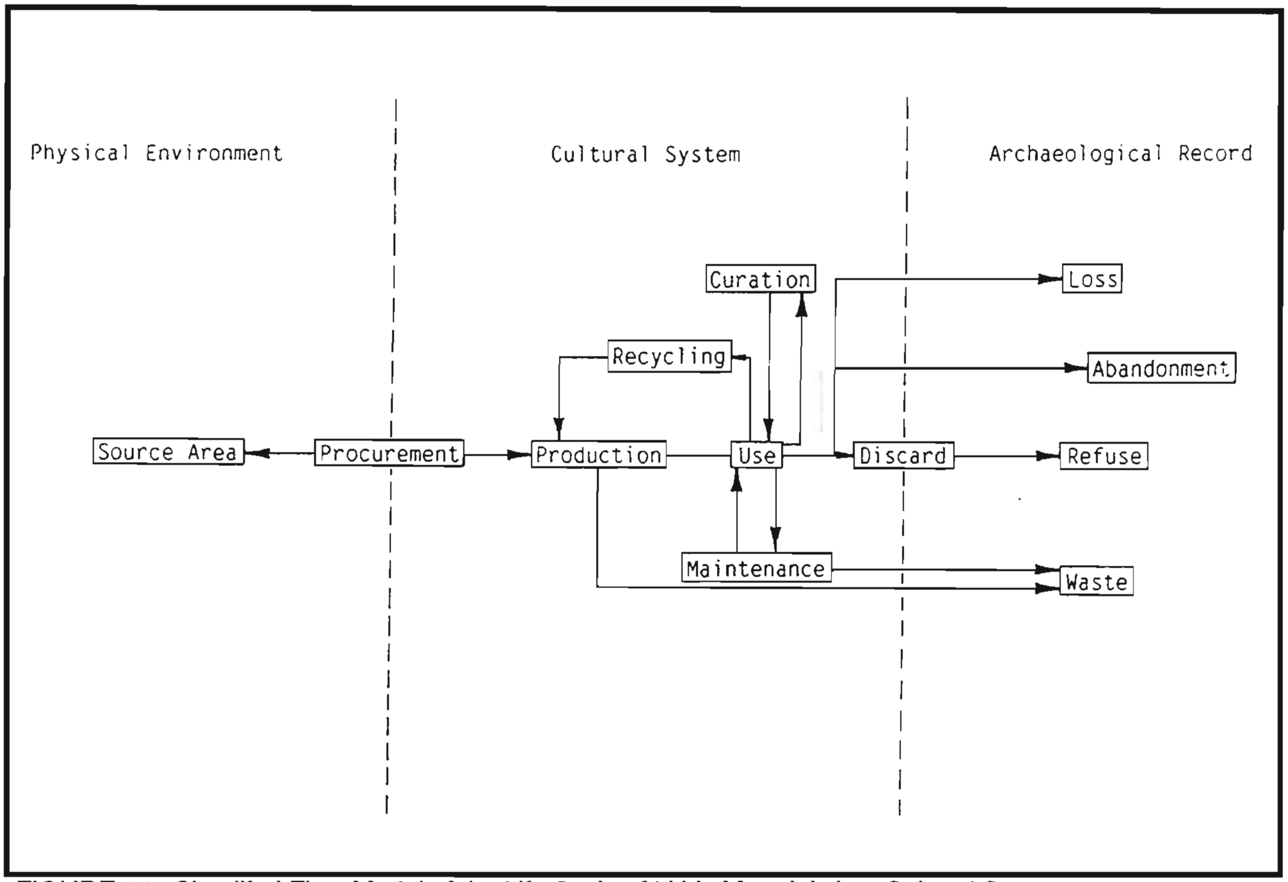


FIGURE 14: Simplifed Flow Model of the Life Cycle of Lithic Materials in a Cultural System.

Tested Cobbles are unmodified cobbles, blocks, or nodules that have had a few flakes detached to examine raw material quality. These cobbles were not worked into tools because they possessed raw material flaws or because they were set aside for future needs, which apparently never arose.

3) Unifaces

Unifaces include both formal tools (e.g., endscrapers) and informal tools (e.g., utilized and edge-retouched flakes). Flakes from cores and bifaces can be used as informal (expedient) tools or worked into formal tools. Five uniface types were recognized, and their raw material, cortex, and condition (whole or broken) were recorded. Whole specimens had their maximum length, width, and thickness recorded in millimeters. Additional functions were entered as notes in the database.

Endscrapers are formalized unifaces that have uniformly retouched edges, which creates a working edge and a standardized shape. The working edge is transverse to the long axis of the tool, and retouching often erases obvious indications that the tool is made on a flake. In some cases, endscrapers are bifacially worked, but they are still classified as unifaces.

Sidescrapers are formalized unifaces that have uniformly retouched edges, which creates a working edge(s) and a standardized shape. The working edge(s) parallels the long axis of the tool, and retouching often erases obvious indications that the tool is made from a flake.

Retouched Flakes are expedient tools that have had one or more edges retouched to resharpen the working edge, to create a dulled edge for grasping, or to form a specific edge angle or shape. The flake itself could have been detached from a core or a biface. It should be noted that severe edge damage can be difficult to discern from intentional retouching.

Utilized Flakes are expedient tools that exhibit traces of use damage and/or polish on one or more edges. These flakes could have been detached from cores or bifaces, and they were employed with no prior modification. Both retouched flakes and utilized flakes represent simple tools that were usually used in cutting and scraping tasks and afterwards discarded.

Denticulated Flakes are a special type of retouched flake. They are distinctive because appropriately spaced flakes have been detached from one or more edges to form a toothed or serrated edge. Various functions have been suggested for this tool type (or tool edge), such as shredding plant fibers or scaling fish, but support for these suggestions is lacking.

4) Bifaces

Bifaces are chipped-stone tools that have been shaped by the removal of flakes from both faces or sides of a cobble or large flake. In most cases, they are hafted and used as projectile points and/or knives. Technically, bifaces are also cores, for the flakes detached from them during production and maintenance can themselves be used as tools (see Kelly 1988). Bifaces were sorted into six types; attributes recorded include raw material, cortex, and condition. Intact bifaces were coded as whole and had their maximum length, width, and thickness recorded in millimeters. Broken bifaces had their condition coded as broken, except for broken projectile points, which were coded as tip, medial section, or base. All bifaces were subjected to a refitting exercise.

Early-Stage Bifaces are cobbles or large flakes that have had their edges bifacially trimmed and a few large reduction flakes detached. These bifacial blanks are equivalent to Callahan's Stage 2 bifaces (Callahan 1979). Because of their crude condition, they can be hard to distinguish from freehand cores and choppers. In fact, early-stage production failures could easily be recycled into these other tool types.

Middle-Stage Bifaces look more like bifaces; they have been initially thinned and shaped. A lenticular cross section is developing, but edges are sinuous, and patches of cortex may still remain on one or both faces. These bifaces are roughly equivalent to Callahan's Stage 3 bifaces (Callahan 1979). Biface reduction is a continuum; therefore, middle-stage bifaces are often difficult to distinguish from early- and late-stage bifaces, depending upon the point at which their reduction was halted. Moreover, rejected bifaces may have been used for other tasks (recycled).

Late-Stage Bifaces are basically finished bifaces; they are well thinned, symmetrical in outline and cross section, and edges are centered. Small areas of cortex may still exist on one or both faces. These bifacial preforms are roughly analogous to Callahan's Stage 4 bifaces (Callahan 1979).

Projectile Points are finished bifaces that were hafted and functioned as projectiles and/or knives. Intact projectile points and basal fragments were assigned to established point types.

Other Bifaces are bifaces that do not easily fit into the above types. Distinctive attributes or apparent functions were recorded as notes in the database.

Indeterminate Biface Fragments are sections of bifaces that are too badly damaged to be assigned to a specific type.

5) Cracked Rock

Cracked rock includes all fragments of lithic debris that cannot be attributed to stone-tool production. Most specimens represent fire-cracked rock (FCR): cobbles that were used in heating and cooking activities. All cracked rock was weighed , but no variables were recorded. All specimens were, however, subjected to a refitting exercise, the details of which are presented elsewhere.

6) Cobble Tools

Cobbles were used for various tasks with little or no prior modification. Battered, crushed, pitted, and/or abraded surfaces identify cobble tools. When multiple functions were evident, the cobble was assigned to the artifact type that best represented its "dominant" or "primary" function; additional functions were recorded as notes in the database. Eight types of cobble tools were identified. Raw material and condition were recorded; and when tools were whole, their maximum length, width, and thickness were recorded in millimeters.

Hammerstones are cobbles that show evidence of battering and crushing along their margins, indicating that they were intentionally used as percussors.

Manos or grinding stones are hand-sized cobbles with one or more flat surfaces that were used to crush and grind various materials, usually vegetable products, as is evidenced by smoothed and polished surfaces.

Anvilstones are cobbles that were used as a base on which to rest materials while they were struck with a hammer. Surfaces that are interpreted as anvils tend to possess shallow, coarse-textured depressions with amorphous outlines. A common activity that could have produced these depressions is bipolar reduction.

Pitted Cobbles or "nutting stones" are cobbles with at least one smooth depression no greater than about 4 cm in diameter. These depressions differ from anvil depressions in that they are smoother, often deeper, and tend to be circular or oval. These depressions are believed to be the result of processing nuts, as compared to anvil depressions.

Metates or grinding slabs are large cobbles with one or two flat or concave surfaces, which exhibit evidence of having been used as durable surfaces for grinding and crushing. These surfaces were used in combination with manos to process seeds and other plant foods.

Pestles are linear cobbles that exhibit crushing and smoothing on one or both ends or poles. Pestles can also be formalized tools that were shaped by pecking and grinding, but the specimens in the Site 7S-F-68 assemblage are merely linear cobbles.

Abraders are pieces of sandstone or related materials that were used to shape and sharpen tools made of various materials. Abraders are believed to have been used in the manufacture and maintenance of bone and wood tools and in the manufacture and maintenance of stone tools.

Other Cobble Tools are cobbles that do not fit into the above types. Key attributes and apparent functions are recorded as notes in the database.

7) Groundstone Tools

These highly formalized tools (and ornaments) were manufactured by pecking, grinding, and sometimes flaking. Typical artifact types are grooved axes, pipes, pendants, and bannerstones. Only one tiny fragment of a groundstone tool was recovered from the site.

8) Minerals

Unmodified or minimally modified crystals or chunks of naturally occurring chemical elements, for example limonite and hematite (iron ores), were classified as minerals. Three types of minerals were recognized: hematite, mica, and other. Under the last type, unmodified fragments of petrified wood were recorded.

b) *Stylistic Analysis*

Only projectile points (or hafted bifaces) were stylistically analyzed. They were segregated into groups on the basis of like morphology and technology. Technology refers to those aspects of production, maintenance, recycling, and hafting that are "recorded" or "preserved" on the surfaces of each specimen. Raw material was not considered a variable, except to the degree that different materials may have affected morphology because of their varying fracture mechanics (see Callahan 1979).

Bifaces were not directly assigned to point types. The hafted bifaces were first sorted into groups based upon shared attributes: overall size and shape, manufacturing and resharpening methods, haft morphology, presence or absence of haft grinding, blade morphology, and presence or absence of blade serration. These groups were then compared to established point types to find a "best fit." Some groups of bifaces fit established types better than others. The following reports were most heavily relied upon in matching these groups with established point types: Broyles (1971), Coe (1964), Ebright (1992), Evans (1984), Funk (1988), Gardner (1974), Gleach (1987), Kinsey (1972), Ritchie (1971), and Stephenson and Ferguson (1963).

Central to the analysis was the realization that hafted bifaces are dynamic entities. As curated tools, they were designed to be maintained, reused, and recycled (see Kelly 1988). Therefore, attempts by archaeologists to construct meaningful typologies must take this fact into account. At the same time, this fact does not negate the usefulness of hafted bifaces as "index fossils" of past cultures.

This issue has recently been debated by Great Basin archaeologists (Bettinger et al. 1991; Flenniken and Raymond 1986; Flenniken and Wilke 1989; Thomas 1986), and a review of the literature indicates that researchers in the Middle Atlantic often fail to consider the effects of resharpening and recycling on projectile point morphology. More often than not, hafted bifaces are sorted into point types as if they were static entities--their current morphology is taken at face value. Individual points, however, would not necessarily have experienced the same numbers and types of impact fractures or resharpening events. Full recognition of this fact may help to alleviate some of the confusion and difficulty currently experienced in establishing a more complete projectile point sequence for the Middle Atlantic region (Custer and Bachman 1986; Evans 1984; Evans and Custer 1990; Wesler 1983, 1985). The excavation of more sites with clearcut stratigraphic sequences and numerous points would be of great benefit in this regard. Site 7S-F-68 is not one of these sites, but it does have contributions to make.

D. LITHIC PROCUREMENT

Raw material analysis of the Site 7S-F-68 assemblage identified 13 different lithic types. Their availability is discussed in the next section, which is followed by a description of each type and a discussion of how they were identified and quantified. The last two sections examine and summarize procurement strategies for chipped-stone tool production. Groundstone tools are not considered because so few were recovered, and most were manufactured from cobbles, which were probably procured along with cobbles intended for chipped-stone use.

1. *The Lithic Landscape*

The term "lithic landscape" refers to the availability of lithic raw materials across a region or set area. Reconstructing the lithic landscape is an essential first step in investigating lithic procurement. It is reconstructed by reviewing geologic reports and maps and by conducting field surveys (see Blanton 1984; Gould and Saggers 1985).

Custer and Galasso (1980) provide a good overview of the lithic landscape of Delaware. In brief, bedrock or primary lithic source areas are restricted to the Fall Line area at the top or northern end of the Delmarva Peninsula. Two important resources in this area are Iron Hill jasper and Cecil County black flint or chert. This resource-rich area is referred to by Wilkins (1976) as the Delaware Chalcedony Complex (Figure 15). South of the Fall Line, gravels or secondary lithic deposits are scattered over the landscape. Some of these deposits are quite extensive and are comparable to primary lithic source areas, "in that they represent focal points on the landscape where large accumulations of lithic materials may be found" (Custer and Galasso 1980:9). In contrast, the rest of the Delmarva Peninsula is characterized as a "lithic-poor setting," where "small isolated pockets of cobble deposits are found" (Custer and Galasso 1980:9).

The area surrounding Site 7S-F-68, including virtually all of the Mid-Peninsular Drainage Divide physiographic zone, falls within this lithic-poor zone, evidenced by the rarity of cobbles and even pebbles in the site area. A limited effort was made to locate naturally occurring lithic cobbles in the headwaters of nearby streams, but none could be found.

Custer and Galasso aptly point out that, because secondary deposits on the Delmarva Peninsula contain cobbles and pebbles that have been transported down the Delaware and Susquehanna Rivers (and their ancestral streams), raw materials from large sections of the Middle Atlantic region could be found within these locally available gravels. However, two important raw materials available within the region--rhyolite and argillite--are less likely to be contained within these secondary deposits (Custer and Galasso 1980:7, 10). Of these two, argillite is more likely to be found within these deposits, but because it weathers so rapidly, cobbles of this material are often of little utility. Hence, these two materials are considered nonlocal resources. However, these secondary (cobble) sources can make it difficult to determine what percentage of the chert, jasper, quartz, and other raw materials in an assemblage were locally procured in cobble form or were procured at a distance from primary sources. Cortex provides the most direct measure of cobble versus bedrock procurement, and mean weight provides a basic index of distance to source (see below).

2. *Raw Material Analysis*

Raw materials were identified on the basis of macroscopic characteristics: color, texture, hardness, and inclusions. A 10X hand lens, and on occasion higher levels of magnification, were used to identify inclusions and to evaluate texture and structure. Archaeological and geological reference collections at the LBA laboratory in East Orange, New Jersey, were consulted during analysis.

Each of the 13 raw material types identified in the assemblage is listed below, with a brief description of its physical characteristics. As mentioned earlier, all lithic artifacts were quantified by count and by weight to the nearest tenth of a gram.

Cortex was recorded for all chipped-stone artifacts as followings: absent, block, cobble cortex, indeterminate cortex, and no observation. Block cortex denotes lithic procurement from primary or bedrock sources, while cobble cortex denotes use of secondary or cobble sources. Generally, block cortex is rugged and coarse textured, while cobble cortex is smooth and often polished. Cobbles can contain internal fracture planes however, and when exposed by knapping, can appear similar to block cortex; in addition, small patches of cortex can be difficult to evaluate. Consequently, cortex was coded as indeterminate when it was unclear whether it was cobble or block. No observation was coded when the presence or absence of cortex could not be determined; this procedure was limited to artifacts manufactured from argillite.

a) *Chert*

Chert is the second most common raw material in the assemblage. A variety of different formations and source areas appear to be represented. But, as discussed above, an array of nonlocal cherts could be locally available in secondary deposits. Although a range of textures and flaking qualities are represented, most chert artifacts are fine grained and are some shade of gray, particularly bluish gray. In part, this is a result of the manner in which chert artifacts were distinguished from jasper artifacts. To avoid confusion, cryptocrystalline materials that are yellow, tan, brown, or reddish brown were considered jasper. It is likely that much of the chert in the assemblage was ultimately derived from the Delaware Chalcedony

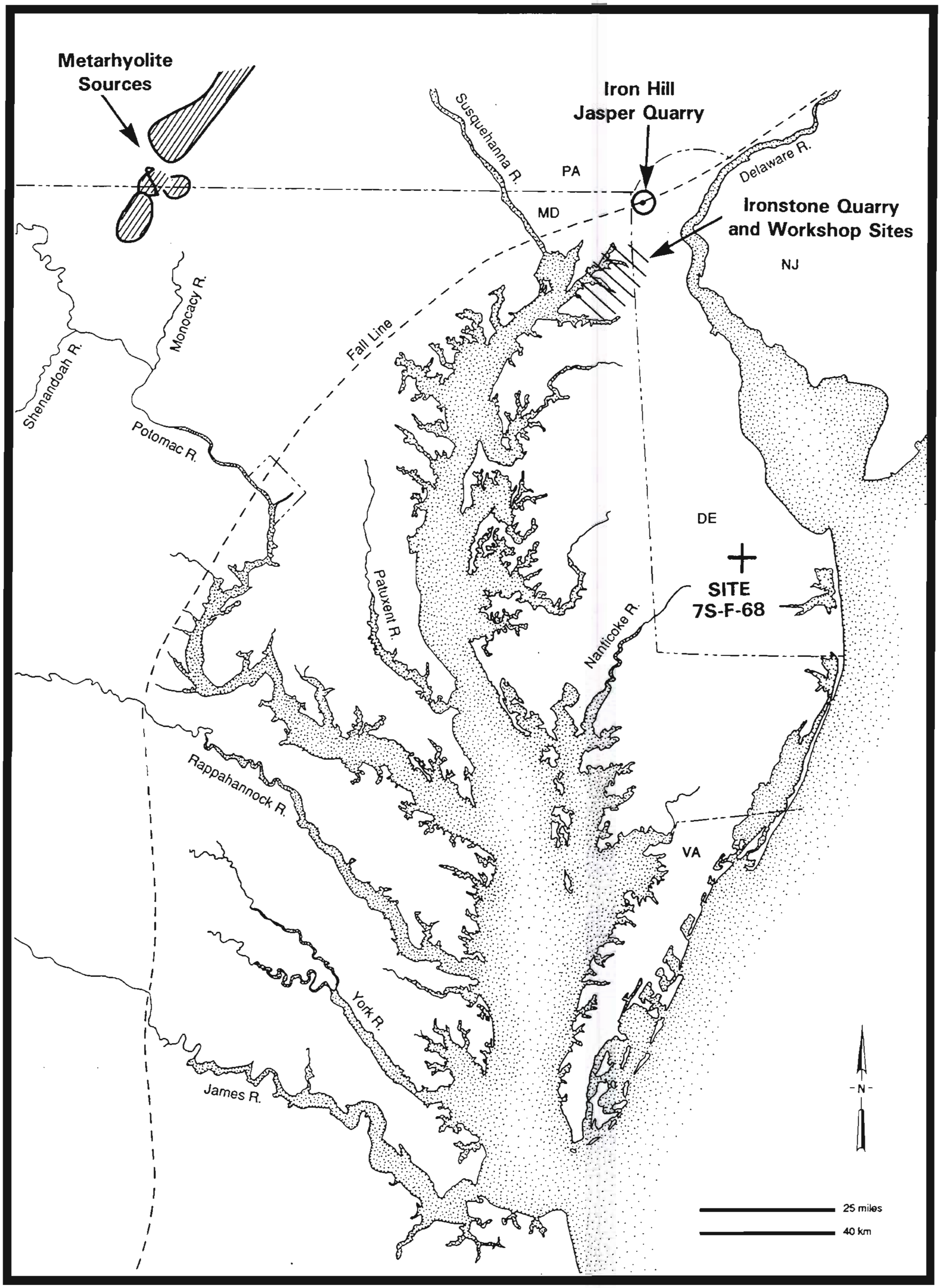


FIGURE 15: Regional Lithic Sources

Complex, either by direct procurement or by procurement from secondary deposits.

b) *Jasper*

In the Site 7S-F-68 assemblage, jasper is the most common raw material. There are several known sources of jasper in the Middle Atlantic region (Hatch and Miller 1985; Stevenson et al. 1990), and as noted above, these jaspers could be locally available in cobble form. However, about half of the jasper in the assemblage is most similar to Iron Hill jasper, which typically exhibits a dark reddish brown color because of its high iron content.

c) *Rhyolite*

Rhyolite is a fine-grained extrusive igneous rock that can be conchoidally fractured. One of its most distinguishing features is quartz and feldspar phenocrysts, which are scattered throughout its matrix in varying quantities. The rhyolite in the 7S-F-68 assemblage is macroscopically indistinguishable from rhyolite deposits in the South Mountain area of northern Maryland and southern Pennsylvania, which are located about 200 km to the northwest (Figure 15). South Mountain rhyolite is in actuality a metarhyolite--that is, it has been subject to metamorphism. In general, this process increases flaking quality and imparts distinctive macroscopic characteristics, which help to separate it from rhyolites in adjacent regions. The exploitation of South Mountain rhyolite has been documented by R. Michael Stewart (1984a, 1984b, 1987, 1989b). Custer and Galasso (1980:10) state that the potential for rhyolite to be contained within cobble deposits is "virtually nonexistent."

d) *Argillite*

Argillite is partially metamorphosed mudstone, which, because of its hardness and fine texture, can be flaked. But it is a very brittle material that weathers rapidly once incorporated in most archaeological contexts. Large deposits of argillite are common in parts of the Middle Atlantic region, with the nearest deposits some 100 km up the Delaware River (Didier 1975). The argillite artifacts in the assemblage are primarily gray and greenish gray and highly weathered, with chalky exteriors. For this study, argillite is considered a nonlocal material because "its susceptibility to weathering means that cobbles would be likely to be small in size and not well suited for the manufacture of stone tools" (Custer and Galasso 1980:7).

e) *Quartz*

Two varieties of quartz were recovered from the site, vein quartz and rock quartz crystal. Rock quartz crystals are large individual crystals, which are transparent or nearly so, while vein quartz occurs as seams of interlocking crystals or massive crystalline structures. Vein quartz dominates the assemblage; rock quartz crystal is limited to a handful of artifacts. Specimens of vein quartz are, on occasion, partially transparent, but more often than not they could be described as opaque and white to light gray in color (i.e., milky quartz). A few specimens of vein quartz are pinkish and could be referred to as rose quartz. Both varieties of quartz are available in the uplands north of the Fall Line (Figure 15) and in secondary deposits south of the Fall Line.

f) *Quartzite*

Quartzite has traditionally been defined as metamorphosed sandstone. Heat and/or pressure transformed the sandstone into a more homogeneous matrix, which more readily transmits fractures through individual sand grains rather than around them. Research by geologists, however, has shown that many quartzites are not the product of metamorphism; rather, quartzites are of two basic types: sedimentary and metamorphic (see Ebright 1987). Sedimentary quartzites (or orthoquartzites) are more common than metamorphic quartzites (or metaquartzites), and they can be described as sandstones that have been cemented together by silica rather than transformed by heat and pressure. The flaking quality of orthoquartzites varies depending upon their degree of cementation: the more weakly cemented, the poorer the flaking quality. Even the best orthoquartzites and metaquartzites can be considered coarse grained and difficult to flake when compared to more homogeneous or isomorphic materials like chert and jasper (see Callahan 1979). A variety of quartzites are present in the assemblage. The level of effort required to distinguish different forms of quartzite exceeds the limits of this project (see Ebright 1987).

g) *Chalcedony*

Like chert and jasper, chalcedony is a cryptocrystalline material. For this study, the term chalcedony is applied to a distinctive fine-grained raw material, which differs from the chert and jasper in the assemblage because it is slightly coarser in texture, more translucent, and usually gray mottled with red and blue. That its texture and fracture mechanics are dissimilar to chert and jasper is apparent in the number of bifaces manufactured from this material that exhibit numerous flake scars with hinge terminations. The source may be the Delaware Chalcedony

Complex, and the material is probably contained within secondary deposits.

h) *Ironstone*

Ironstone is sand that has been welded together by the accretion of iron. Deposits of such materials are a common feature of the Coastal Plain, and because of its depositional history, it has been referred to as "bog iron" (see Vokes and Edwards 1974). Just south of the Fall Line (Figure 15), large deposits of fine-grained ironstone were exploited by prehistoric populations for the production of chipped-stone tools (Ward 1988). This raw material was little used by the groups that occupied Site 7S-F-68.

i) *Siltstone*

Siltstone is a fine-grained sedimentary rock. Only a few artifacts in the assemblage have been assigned to this material type, some of which have properties that are similar to low-grade chert.

j) *Sandstone*

Sandstone is a coarse-grained sedimentary rock, similar to ironstone, but its primary welding agent is not necessarily iron. Like siltstone, it is poorly represented in the assemblage.

k) *Steatite*

Steatite or soapstone is a fine-grained, compact, metamorphic rock, whose principal constituent is talc. This soft but durable material is ideal for manufacturing stone bowls and other groundstone implements. Steatite quarries have been reported from Washington, D.C., as well as from other areas of the Middle Atlantic (Holland et al. 1981; Holmes 1897). This material is represented in the assemblage by a tiny fragment of a groundstone tool.

l) *Igneous/Metamorphic*

Grouped under this type are a number of different igneous and metamorphic rock types, which are available north of the Fall Line in primary deposits and south of the Fall Line in secondary deposits. The most common materials in the assemblage are basalt (or diabase) and schist.

m) *Indeterminate*

Artifacts that could not be assigned to one of the above raw material types with a high degree of confidence were classified as indeterminate. Examples of such artifacts are tiny pieces of debitage and artifacts that have been severely burned.

3. *Procurement Strategies*

As previously mentioned, the lithic assemblage as a whole is dominated by chipped-stone tools and debitage. Jasper is, by count, the most common raw material used in chipped-stone tool production, but by weight, quartzite is the most common (Table 8). By count, the raw materials fall into the following order: jasper (56.0%), chert (19.5%), quartz (14.0%), quartzite (5.9%), (1.5%), chalcedony (0.9%), rhyolite (0.3%), igneous/metamorphic (0.2%), ironstone (0.2%), and indeterminate (1.4%). By weight, the order is different: quartzite (25.0%), jasper (23.4%), argillite (21.3%), quartz (16.5%), chert (9.1%), igneous/metamorphic (1.9%), chalcedony (1.4%), ironstone (0.7%), rhyolite (0.2%), and indeterminate (0.5%).

Jasper was clearly an important raw material, because it accounts for more than half of the chipped-stone assemblage by count and almost one-quarter of the assemblage by weight. That the raw materials do not follow the same order of popularity by count as by weight is expected: not all of the raw materials have the same availability across the landscape, nor do they have identical flaking properties. Those raw materials that flake the best should account for more of the assemblage by count than by weight because they would be reduced more intensively. For example, jasper, chert, and quartz (vein and crystal) account for 90 percent of the assemblage by count, but only 49 percent of the assemblage by weight. Differences in raw material availability and reduction strategies can be further documented by examining mean weight and cortex.

a) *Mean Weight*

Mean weight provides important insights into procurement and production, especially when coupled with a basic understanding of the local and regional lithic landscape. Given that large lumps of raw material require considerable effort to transport and that stone-tool production and maintenance is a subtractive process, it is generally accepted by researchers that the amount (or mean weight) of a particular raw material should decrease as one moves away from that raw material's source area (see Erickson and Purdy 1984; Renfrew 1977).

With this generalization in mind, note that chert and jasper have the same mean weight (0.6 g), which is undoubtedly a product of similar availability and similar procurement and reduction strategies. Indeterminate materials have the lowest mean weight (0.5 g), which is expected because the smallest artifacts are the most difficult to identify with certainty.

Rhyolite has the next lowest mean weight (0.9 g), and its low mean weight is expected because it is considered a nonlocal raw material. Likewise, then, argillite should have a low mean weight because it is also considered to be a nonlocal material. But this is not the case; argillite has the highest mean weight (20.4 g). If the very large, early-stage argillite biface (1491.0 g) from Feature 33 is deleted from the total count and weight for argillite (Table 8), the mean weight for argillite is reduced to 3.4 g, which more closely fits what is expected for a nonlocal raw material. Furthermore, it should be remembered that the mean weight of argillite is artificially inflated by the nonrecovery of small argillite debitage--resulting from its susceptibility to erosion. Vein and crystal quartz, combined, have a low mean weight (1.7 g), followed by chalcedony (2.2 g). After these raw materials, mean weight values greatly increase: ironstone (4.5 g), quartzite (5.8 g), and igneous/metamorphic (11.7 g). This is partly explicable by coarse texture and lower flaking quality of the latter materials.

The mean weight for each material's debitage assemblage is as follows: jasper, rhyolite, and indeterminate materials have the same value (0.4 g), followed by chert (0.5 g), ironstone (0.9 g), vein quartz and crystal quartz combined (1.2 g), chalcedony (2.0 g), argillite (2.4 g), quartzite (2.6 g), and igneous/metamorphic (4.9 g). The pattern is basically the same as above: jasper, chert, rhyolite, and indeterminate materials have the lowest mean weights, and quartzite and igneous/metamorphic materials have the highest. That argillite has a relatively high mean weight, even though it is considered nonlocal, is again attributed to its susceptibility to erosion.

However, another factor that may be contributing to the high mean weight of argillite is its method of procurement. Unlike those raw materials with low mean weights (rhyolite, jasper, and chert), it is possible that argillite was procured indirectly through exchange contacts in the Delaware Valley, while these other raw materials were procured directly from source areas as part of a group's seasonal movements. With the second scenario, "embedded" procurement (Binford 1979), tools and preforms made from a particular raw material are "consumed" (used, resharpened, and discarded) across the landscape; thus, mean weight should decrease as distance from source increases. In the first scenario, exchange, the rule of decreasing mean weight may not be expressed in the same way because large preforms or cores may have been transported from one region to another with little or no reduction. The large argillite biface from Feature 33 could exemplify the form in which argillite arrived at the site. That the only diagnostic bifaces manufactured from argillite are believed to be from the Late Archaic and Early Woodland periods lends credence to the above scenario because these periods are characterized as a time of increased exchange and reduced mobility (e.g., Custer 1988). Nevertheless, both scenarios are speculative and warrant further investigation. It is important to mention that the rhyolite sample is much smaller than the argillite sample and that the large argillite biface (Feature 33) was found stratigraphically below the argillite stemmed points.

Overall, analysis of mean weight supports the appraisal of rhyolite and argillite as nonlocal raw materials (i.e., unavailable on the Delmarva Peninsula), and their procurement was apparently achieved under different strategies: argillite procured via exchange and rhyolite procured by visits to its source area. The low mean weights for chert and jasper may in part be explained by long-distance procurement from bedrock sources (e.g., Delaware Chalcedony Complex), but these values are also a condition of the superior flaking quality of these materials and the absence of lithic raw materials in the site vicinity. If raw materials must be maximized, the higher quality materials will tend to be the focus of that maximization (e.g., Goodyear 1979, 1993). This interpretation may also apply to crystal quartz, for when it is separated from vein quartz, it has a low mean weight, 0.5 g. So, by mean weight alone, it cannot be determined whether jasper, chert, and quartz were primarily procured from local cobble sources or from more distant bedrock sources. Cortex provides another line of evidence.

b) *Cortex*

Lithic raw materials come in different kinds of "packages," and the exteriors of these packages furnish clues about where they can be found on the landscape. Cobbles are small lumps of raw material that have been transported by natural processes to secondary locations; their rinds or cortex bear the marks of this transportation. In contrast, raw materials collected from primary sources do not bear the marks of natural transportation. Therefore, as discussed above, cobble cortex implies secondary deposits, and block cortex implies primary deposits. Drawing upon the work of Custer and Galasso (1980), it can be stated with confidence that the only raw material sources on the Delmarva Peninsula below the Fall Line are secondary deposits, except for ironstone. However, this material is of little consequence in the assemblage. In simple terms, cobble cortex equals "local" procurement--that is, raw materials were obtained from somewhere on the Delmarva Peninsula; and block cortex equals "nonlocal" procurement--that is, raw materials were obtained from somewhere at or above the Fall Line.

Cortex types are summarized for each raw material in Table 13. Most of the raw materials have both types

Table 13: Summary of Cortex Types by Raw Material for the Chipped-Stone Assemblage

RAW MATERIAL		CORTEX TYPE* A	C	B	I	X	TOTAL
Jasper							
	Count	2,560	794	40	19	.	3,413
	Weight	748.8	1156.2	35.9	24.0	.	1964.9
Chert							
	Count	947	212	16	11	1	1187
	Weight	322.0	348.0	67.8	26.7	1.2	765.7
Quartz							
	Count	638	206	5	6	.	855
	Weight	563.6	809.5	13.5	3.6	.	1390.2
Quartzite							
	Count	304	48	5	3	.	360
	Weight	666.5	1133.5	291.2	5.9	.	2097.1
Argillite							
	Count	.	.	.	.	88	88
	Weight	.	.	.	.	1791.1	1791.1
Chalcedony							
	Count	38	11	3	.	.	52
	Weight	28.1	10.2	76.0	.	.	114.3
Rhyolite							
	Count	18	.	.	.	.	18
	Weight	15.7	.	.	.	.	15.7
Igneous/Metamorphic							
	Count	6	5	1	1	1	14
	Weight	37.8	90.4	4.1	29.9	1.6	163.8
Ironstone							
	Count	11	.	2	.	.	13
	Weight	8.1	.	50.9	.	.	59.0
Indeterminate							
	Count	76	3	.	4	2	85
	Weight	32.6	8.6	.	0.6	0.5	42.3
TOTAL	Count	4,598	1,279	72	44	92	6,085
	Weight	2,423.2	3,556.4	539.4	90.7	1,794.4	8,404.1

* A = absent; C = cobble; B = block; I = indeterminate; X = no observation.

of cortex represented, but artifacts with cobble cortex far outnumber those with block cortex. This relationship can be expressed as the ratio of block cortex to cobble cortex: jasper 1:20, chert 1:13, quartz (vein and crystal) 1:41, quartzite 1:10, chalcedony 1:4, and igneous/metamorphic 1:5. The presence of block and cobble cortex indicates that both primary and secondary sources were exploited, but the ratios show that secondary (cobble) sources were exploited more frequently than primary sources. This pattern is certainly not unexpected, given that the site is located a considerable distance from the Fall Line (Figure 15). The quartz assemblage most strongly expresses this pattern of local procurement: for every quartz artifact with block cortex there are 41 with cobble cortex. There are only five quartz artifacts with block cortex (one of which is crystal quartz). Therefore, it appears that quartz was almost exclusively procured in cobble form from local deposits. In contrast, ironstone artifacts only possess block cortex, and rhyolite artifacts possess no cortex (Table 13).

In the debitage assemblage (Table 14), similar ratios are seen: jasper 1:19, chert 1:12, quartz 1:48, quartzite 1:12, chalcedony 1:4, and igneous/metamorphic 1:4. As above, ironstone is only represented by block cortex, and rhyolite lacks cortex of any kind.

Certainly then, cobble sources were exploited much more frequently than bedrock sources, especially for the most commonly used raw materials--jasper, chert, quartz, and quartzite. It is necessary, however, to consider what proportion of each raw material type possesses cortex because, like mean weight, it can be argued that cortex should become less common as distance from a source increases. In terms of this study, bedrock sources clearly are more distant than cobble sources.

The proportion of cortex to no cortex is expressed for the main raw material types as the ratio of the number of artifacts with cortex (any type) to the number of artifacts without cortex: jasper 1:3, chert 1:4, quartz 1:3, and quartzite 1:5. The ratios are rather consistent; for each artifact with cortex there are three, four, or five artifacts without cortex. The debitage assemblage contains similar ratios for these same raw materials. As a whole, the chipped-stone assemblage has a ratio of 1:3. Stated another way, 23 percent of the chipped-stone artifacts possess some form of cortex, and of the cortex represented, 92 percent is cobble cortex, 5 percent is block cortex, and 3 percent is indeterminate cortex. In turn, 77 percent of the chipped-stone artifacts lack cortex. This is a fairly high percentage rate, which supports the notion that raw material sources (of any kind) were not close by, and it can be taken as support for the notion that the raw material for many of the artifacts without cortex may have been procured from primary sources at or above the Fall Line.

This latter statement cannot be easily confirmed, because if an artifact lacks cortex it is not easily determined whether that artifact is derived from a cobble or bedrock source. Nonetheless, it does seem likely that more than 72 artifacts--those that possess block cortex' (Table 13)--was procured from primary sources. Yet it cannot be determined exactly how many more than that were derived from such sources.

The issue of bedrock resources is important; Lowery and Custer (1990), in analyzing the Early Archaic lithic assemblage from the Crane Point Site in nearby Maryland, argue for the almost exclusive use of primary lithic sources, with these materials being transported onto the Delmarva Peninsula as bifacial cores. As just discussed, at Site 7S-F-68 there is little hard evidence that bedrock sources were intensively exploited; at best, it can be speculated that both bedrock and cobble sources were equally exploited.

Early Archaic lithic procurement is discussed below, but before leaving this issue, it is important to note that the ratio of artifacts with cortex to those without cortex for the debitage assemblage from Site 7S-F-68 is identical to that obtained for Crane Point Site: namely, 1:3. In addition, when the presence of cortex is expressed as a percentage, they are within three points of each other: 22 percent of the debitage at Site 7S-F-68 possess cortex, and 25 percent of the debitage at the Crane Point Site possess cortex. The three most common raw materials in both debitage assemblages are jasper, chert, and quartz (Lowery and Custer 1990:table 3).

c) *Patterns of Procurement*

The question to be addressed is, How did lithic procurement change through time at the site? Special attention is given to Early Archaic procurement. Two data sets are best suited to examine this question, the temporally diagnostic bifaces and the lithic materials assigned to the Early, Middle, and Late analytical units (see previous chapter for unit designations). The bifaces are discussed first.

As discussed in the previous chapter, 76 projectile points were recovered from the site (Table 10), 34 of which are assigned to cultural components (Table 11). A possible fluted point component is represented by a late-stage biface manufactured from crystal quartz, which is believed to be a fluted point production failure (Plate 6). In addition, a crystal quartz point tip was recovered from the surface of the site, and it resembles the tip of a resharpened fluted point both in shape and flaking patterns. It is noteworthy that the three fluted points recovered from the Higgins Site in Maryland are manufactured from crystal and vein quartz (Ebright 1992) and that a number of crystal quartz fluted points have been recovered from the Williamson Site in Virginia (Peck 1985). Because no other diagnostic artifacts in the Site 7S-F-68 assemblage are made from crystal quartz, it can be argued that all 35 crystal quartz tools and debitage in the assemblage belong to the fluted point component. A biface-reduction flake used as a cutting tool is shown in Plate 15.

Also recovered from the surface is a possible late Paleoindian lanceolate point made from jasper (Plate 7). Little else can be said about this possible component.

As a group, the 19 Early Archaic points are manufactured primarily from cryptocrystallines (Plates 8-10): 8 jasper, 6 chert, 2 vein quartz, 2 quartzite, and 1 chalcedony. Jasper and chert account for 74 percent of these early points, a pattern that is typical for the Delmarva Peninsula (Custer 1984). Because 86 percent of all chert points and 57 percent of all jasper points are Early Archaic point types, it is reasonable to argue that the majority of the chert and jasper tools and debitage are products of the Early Archaic component, especially the endscrapers and sidescrapers (Plates 16 and 17). Also, the only diagnostic points manufactured from vein quartz are Early Archaic (e.g.,

TABLE 14: SUMMARY OF CORTEX TYPES BY RAW MATERIAL FOR DEBITAGE

RAW MATERIAL		CORTEX TYPE* A	C	B	I	X	TOTAL
Jasper							
	Count	2,495	739	39	15	.	3,288
	Weight	614.4	709.1	35.1	10.4	.	1,369.0
Chert							
	Count	919	188	16	10	1	1,134
	Weight	237.8	208.6	67.8	12.1	1.2	527.5
Quartz							
	Count	621	191	4	6	.	822
	Weight	510.7	430.7	7.9	3.6	.	952.9
Quartzite							
	Count	300	46	4	3	.	353
	Weight	637.6	278.2	6.1	5.9	.	927.8
Argillite							
	Count	.	.	.	.	73	73
	Weight	.	.	.	.	171.2	171.2
Chalcedony							
	Count	34	11	3	.	.	48
	Weight	10.0	10.2	76.0	.	.	96.2
Rhyolite							
	Count	16	.	.	.	.	16
	Weight	6.0	.	.	.	.	6.0
Igneous/Metamorphic							
	Count	5	4	1	.	.	10
	Weight	10.5	34.8	4.1	.	.	49.4
Ironstone							
	Count	11	.	1	.	.	12
	Weight	8.1	.	2.5	.	.	10.6
Indeterminate							
	Count	76	2	.	4	2	84
	Weight	32.6	0.7	.	0.6	0.5	34.4
TOTAL	Count	4,477	1,181	68	38	76	5,840
	Weight	2,067.7	1,672.3	199.5	32.6	172.9	4,145.0

* A = absent; C = cobble; B = block; I = indeterminate; X = no observation.

Plate 10:c); thus, it can be argued that most of the vein quartz tools and debitage are products of the Early Archaic component. This same argument can be made for quartzite (Table 11).

Following Ebright's work at the Higgins Site (1992), the Otter Creek point in the Site 7S-F-68 assemblage is considered Middle Archaic, and like many of the Otter Creek points at the Higgins and Indian Creek V sites (LeeDecker et al. 1991), it too is manufactured from rhyolite. In fact, it is highly probable that all 18 rhyolite artifacts from the site belong to the Otter Creek component because no other diagnostic artifacts are made from rhyolite.

The heterogeneous group of 12 stemmed points that are believed to represent a Late Archaic/Early Woodland component are primarily made from argillite (Plates 12-14): 7 argillite, 4 jasper, and 1 chert. As discussed in the preceding chapter, while it is likely that several different components are represented by the stemmed points, it is significant that the use of argillite is restricted to stemmed points. In other words, earlier points are not made from argillite, and the importance of this pattern has been discussed by Custer (1984, 1986b, 1988). Thus, it is likely that all of the argillite tools and debitage in the assemblage are part of the Late Archaic/Early Woodland component. However, it is puzzling that the large argillite biface (Feature 33) recovered from the site

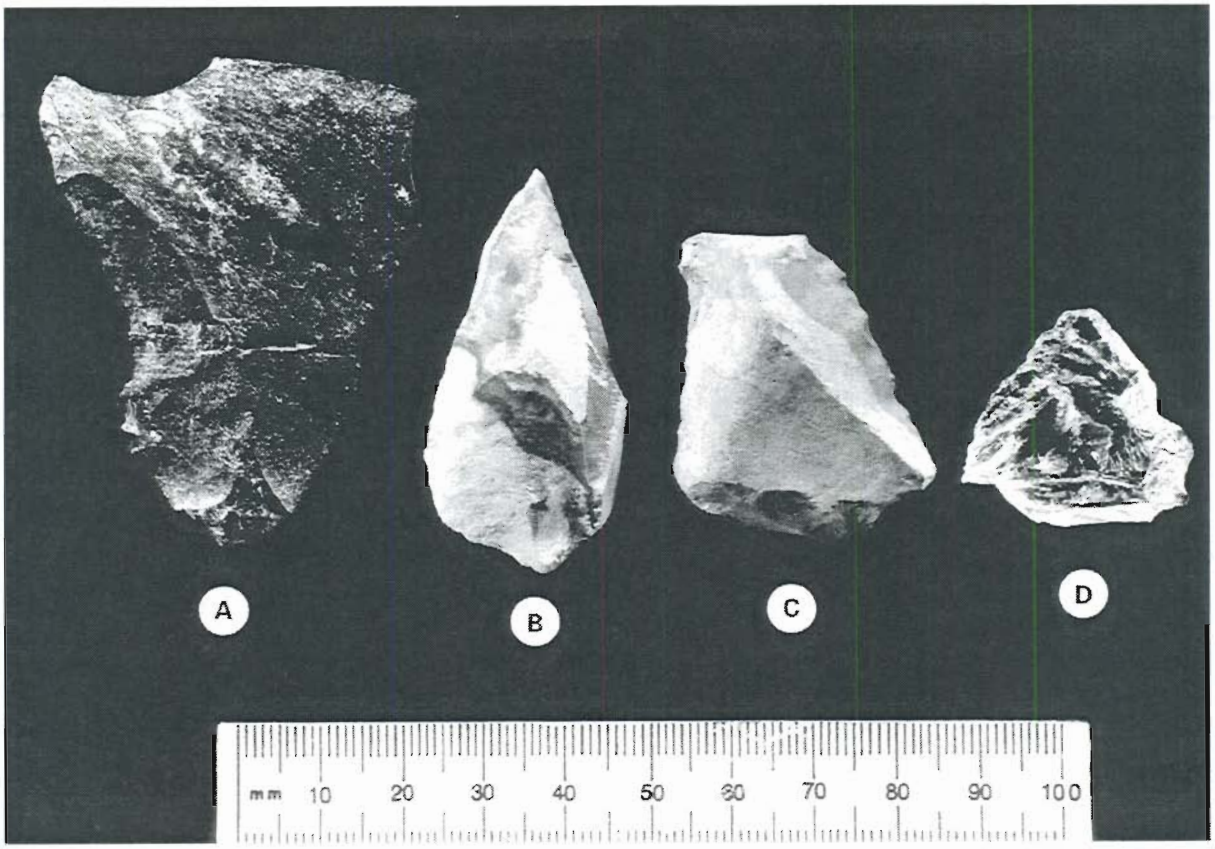


PLATE 15: Flake Tools. A: Retouched Flake, Chert, Cat. No. 11 (Shovel Test N106/E100, Stratum B); B: Retouched Flake, Jasper, Cat. No. 158 (Excavation Unit 14, Stratum B, Level 3); C: Retouched Flake, Jasper, Cat. No. 1231 (Excavation Unit 50, Stratum A, Level 1); D: Utilized Flake, Quartz Crystal, Cat. No. 1354 (Excavation Unit 51, Stratum B, Level 5).

was found below the argillite stemmed points (Plate 18).

The Late Woodland component is represented by a single triangular arrowpoint manufactured from jasper that was recovered from the upper levels of the site. This point is undoubtedly part of the same component that deposited the small sample of Townsend/Rappahannock ceramics at the site, and it is likely that a limited number of jasper tools and debitage were deposited at the site by this component.

In review, change through time is evident in the biface assemblage: the possible fluted point component utilized crystal quartz; the Early Archaic component primarily utilized jasper and chert; the Otter Creek component (Middle Archaic) utilized rhyolite; the Late Archaic/Early Woodland component used more argillite than any other raw material; and the Late Woodland component utilized jasper. Rhyolite and argillite are the only raw materials that are not available on the Delmarva Peninsula. In addition, it is likely that quartz crystals were obtained from sources at or above the Fall Line.

Analysis of patterns in raw material use may also be carried out for the Early, Middle, and Late analytical units (AUs). These units contain larger sample sizes and include other artifact types in addition to diagnostic bifaces, but they are coarser temporal units and exhibit clear evidence of mixing, as may be seen in the distribution of point types (Table 15). It is significant that, while the Middle and Late AUs contain a mixture of point types, the Early AU contains, with two exceptions only Early Archaic points; the exceptions are two Late Archaic/Early Woodland stemmed points, one of which is made from jasper and could be classified as a Morrow Mountain point (Plate 12:a). Consequently, Early Archaic procurement is emphasized in the ensuing discussion.

If the Early AU is representative of an Early Archaic occupation, it should be dominated by jasper, chert, vein quartz, and quartzite. This is certainly the case (Table 16). However, although jasper and chert are

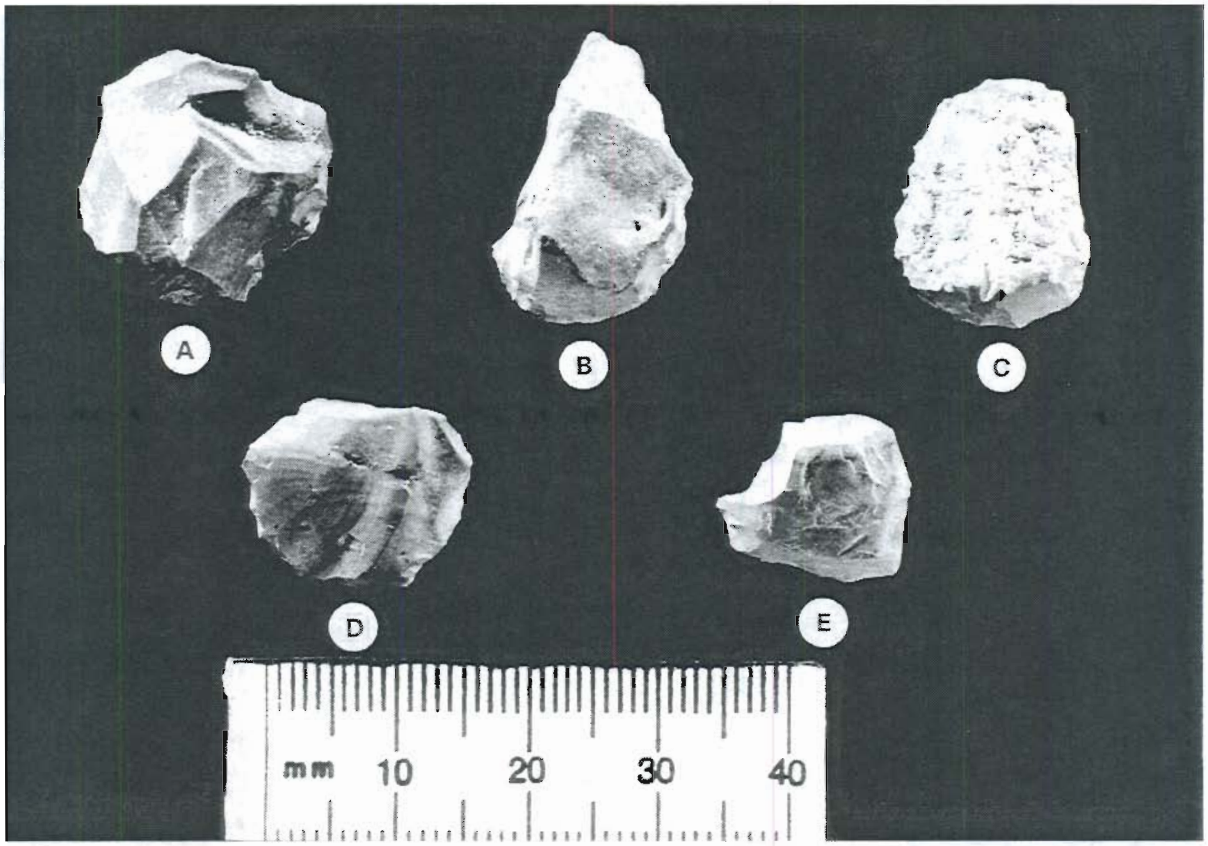


PLATE 16: Endscrapers. A: Chert, Cat. No. 1121 (Excavation Unit 23, Stratum A, Level 1); B: Jasper, Cat. No. 354 (Excavation Unit 33, Stratum B, Level 8); C: Jasper, Cat. No. 240 (Excavation Unit 20, Stratum B, Level 3); D: Jasper, Bear Family-Level Blood Residue, Cat. No. 262 (Excavation Unit 22, Stratum B, Level 2); E: Jasper, Cat. No. 125 (Test Unit 12, Stratum B, Level 5).

dominant raw materials in the Middle and Late AUs as well, vein and crystal quartz and quartzite are most common in the Early AU, supporting the early use of these materials. The popularity of jasper and chert in the Middle and Late AUs may, in part, be explained by the use of local cobbles for flake tools. Mixing of the deposits is an additional explanation, and in this case, one would expect to find little argillite in the Early AU. Nonetheless, there are only 12 more pieces of argillite in the Middle AU than in the Early AU, and by weight, there is more argillite in the Early AU than in the Middle AU (Table 16). If the weight of the large argillite biface (1491.0 g) contained in the Early AU is subtracted from the total argillite weight for the Early AU, this total comes much closer to the argillite total for the Middle AU, but it is still larger (Early AU 146.7 g and Middle AU 114.3 g). At this time, it is believed that the presence of argillite in the Early AU is the result of mixing. Of course, it is possible that argillite was utilized by the Early Archaic occupants of the site, but this seems unlikely because no Early Archaic points in the assemblage are manufactured from this material. Moreover, Custer (1984) reports few Early Archaic points manufactured from argillite.

Even if there is some mixing of materials, it is likely that the majority of the jasper, chert, vein quartz, and quartzite in the Early AU is related to the Early Archaic occupation. Thus, the issue of Early Archaic lithic procurement can be examined with the cortex totals in Table 17. As with the rest of the assemblage, block cortex is poorly represented. This pattern can be expressed as the ratio of block cortex to cobble cortex: jasper 1:25, chert, 1:13, and vein quartz 1:102 (no block cortex for quartzite). For these materials combined, the ratio of cortex to no cortex is 1:4, which is similar to the overall assemblage. Cobble cortex is common because cobble sources are more readily available than bedrock sources. As already discussed, however, because bedrock sources are more distant, it is more likely that artifacts made from bedrock lithics will retain less cortex than artifacts made from cobble lithics. But, again, if an artifact lacks cortex it is difficult to determine if that artifact was made from a cobble or bedrock block.

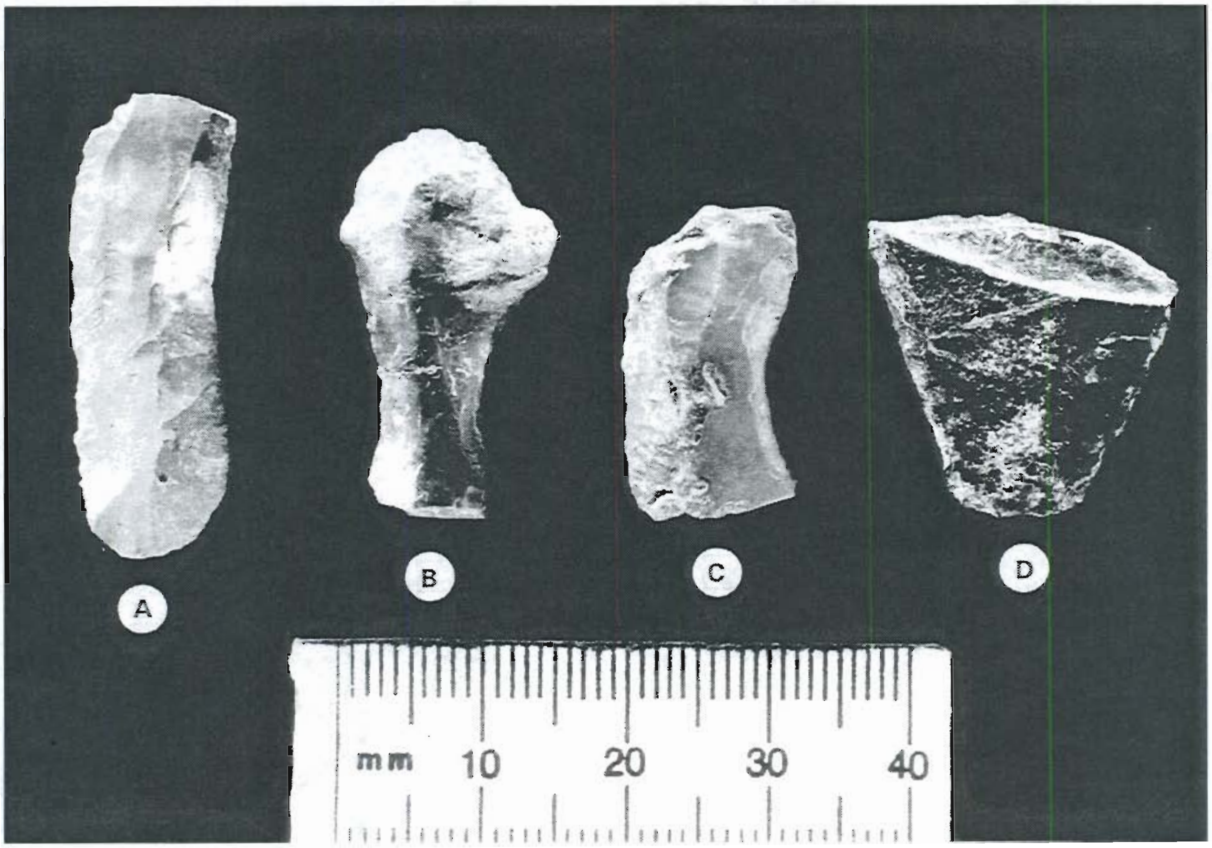


PLATE 17: Side Scrapers. A: Jasper, Cat. No. 610 (Excavation Unit 27, Stratum B, Level 6); B: Chert, Cat. No. 565/1085 (Excavation Unit 21, Wall Collapse and Excavation Unit 18, Stratum B, Level 3); C: Jasper, Cat. No. 558 (Excavation Unit 21, Stratum , Level 5); D: Chert, Cat. No. 982 (Excavation Unit 52, Stratum B, Level 2).

Following the arguments made by Lowery and Custer (1990), if bedrock lithics were transported to the site by Early Archaic groups, it is most likely that these materials would have arrived in the form of bifaces. No Early Archaic points possess cortex, but if the entire biface assemblage is examined, it is clear that block cortex is poorly represented: 3 block, 21 cobble, and 2 indeterminate. Only one of the bifaces with block cortex is made from jasper; the other two are made from quartzite and ironstone. The bifaces with cobble cortex are made from jasper (9), chert (7), vein quartz (4), and quartzite (1). Similarly, only one uniface possess block cortex, and it is made from crystal quartz (Plate 15:d).

Consequently, there is little hard evidence of intensive exploitation of bedrock lithic sources at the site. This statement holds true for the entire assemblage, as well as for the Early Archaic component. It is likely that bedrock sources were exploited, but it is problematic to assert that lack of cortex is evidence to indicate bedrock procurement, especially if similar raw materials are locally available in secondary deposits. If bedrock sources were heavily relied upon by Early Archaic groups living on the Delmarva Peninsula, considerable retooling (with cobble lithics) had apparently occurred by the time these groups reached the site. If suitable raw materials are available in cobble form, it seems reasonable to assume that Early Archaic groups would have taken advantage of these local resources. It appears, too, that later groups also used these local cobble resources. But Middle Archaic (Otter Creek) people and Late Archaic/Early Woodland people brought nonlocal raw materials--rhyolite and argillite, respectively--onto the peninsula. This also seems to be the case for the fluted point component, with its utilization of crystal quartz.

In conclusion, it appears that the Early Archaic occupants of the site primarily used local cobbles for chipped-stone tool production. But this does not mean that they did not utilize bedrock sources situated at or above the Fall Line. If these lithic sources were exploited, it appears that the Early Archaic assemblage from Site 7S-F-68 could be said to represent a locally "retooled" assemblage. Hence, the Site 7S-F-68 assemblage may be more like the lithic assem

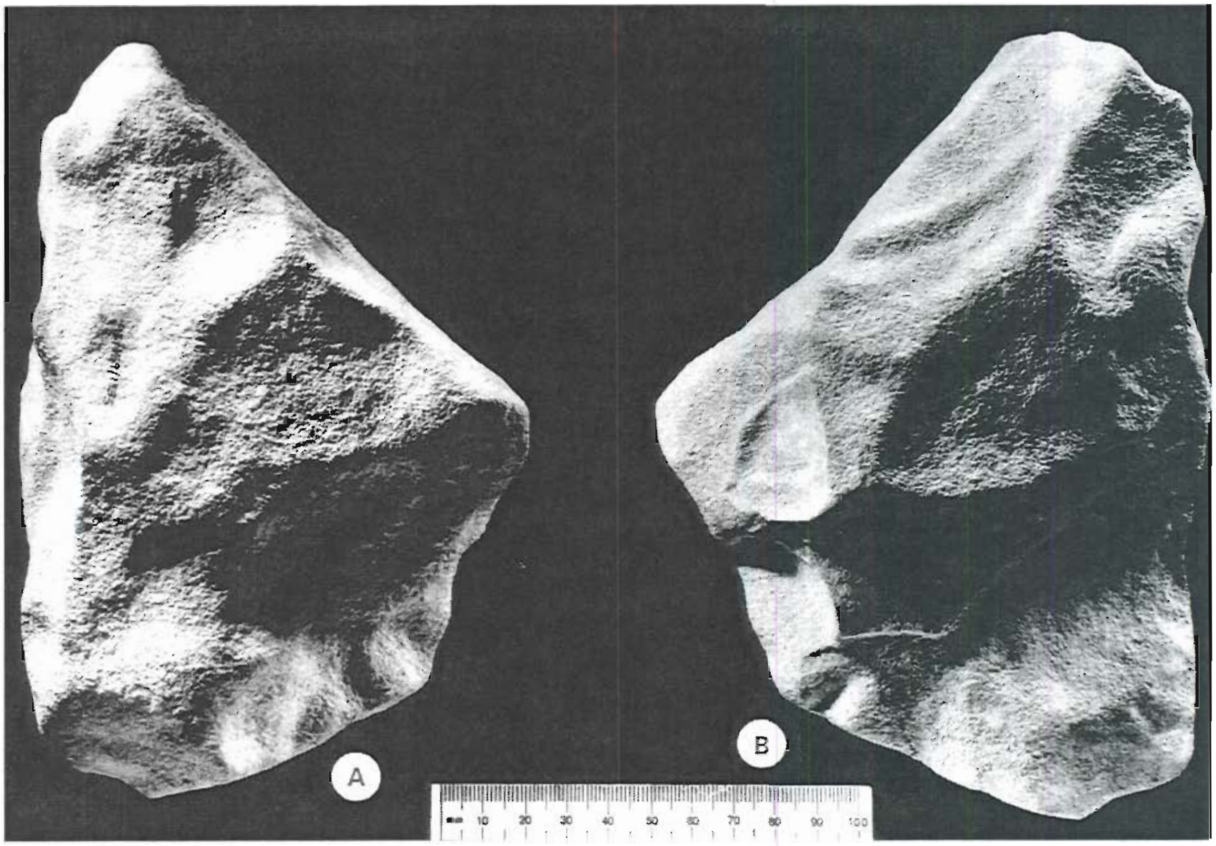


PLATE 18: Early Stage Biface, Argillite, Cat. No. 1335 (Excavation Unit 41, Feature 33,). A: Obverse; B: Reverse.

blage from the Paw Paw Cove Site in Maryland (Lowery 1989) than like the Crane Point Site: as they are characterized by Lowery and Custer (1990:115), "At Paw Paw Cove, lithic resources in the tool kits were clearly depleted and it was necessary for these groups to exploit any available local cobble resources. On the other hand, groups at Crane Point had a much less depleted tool kit and did not have to exploit secondary sources to as great an extent as the groups at Paw Paw Cove." However, as noted earlier, the debitage assemblage from Site 7S-F-68 is very similar to the debitage assemblage from the Crane Point Site, both in raw materials and frequency of cortex. If the above interpretations are correct, similar cortex frequencies would not be expected. This issue requires further study, which is beyond the scope of this report. The main point to be made is that Early Archaic groups on the Delmarva Peninsula utilized cobble resources, and data from Site 7S-F-68 indicate that these secondary sources were exploited more intensively than bedrock sources because secondary sources were closer and because they contained cryptocrystallines (chert and jasper).

E. LITHIC INDUSTRIES AND SITE ACTIVITIES

The lithic assemblage is made up of 6,409 artifacts that have been assigned to various tool and debris types that are believed to be indicative of specific activities or behaviors that take place at Site 7S-F-68. Related types are grouped into eight classes: bifaces, unifaces, cores, debitage, groundstone, cobble tools, cracked rock, and minerals. In the following discussion specific tool and debris types are first considered by class, and attempts are then made to reconstruct site activities and the arrangement of these activities.

1. *Artifact Classes*

a) *Bifaces*

In total, 125 bifaces were recovered, 68 percent of which were manufactured from jasper and chert (Table 10). Sixty percent of the bifaces are projectile points, and 14 percent are unfinished points, most of which appear to be production failures and rejects. The low number of failures and rejects supports earlier statements about the site's considerable distance from significant raw material sources. The production failures and rejects are manufactured from jasper (5), chert (5),

TABLE 15: SUMMARY OF PROJECTILE POINTS BY ANALYTICAL UNITS

ANALYTICAL UNITS/ POINT TYPES	RAW MATERIAL JASPER	CHERT	ARGIL-LITE	QUARTZ	QUART-ZITE	CHAL-CEDONY	RHYO-LITE	TOTALS
EARLY AU								
Generalized Early Archaic	.	1	.	1	.	.	.	2
Kirk Corner Notched	1	.	.	.	.	.	.	1
Kirk Stemmed	.	1	.	.	.	1	.	2
Bifurcate Base	1	2	.	.	.	.	.	3
Late Archaic/E. Woodland	1	.	1	.	.	.	.	2
SUBTOTAL	3	4	1	1	.	1	.	10
MIDDLE AU								
Generalized Early Archaic	2	.	.	.	.	.	.	2
Kirk Stemmed	1	.	.	.	1	.	.	2
Bifurcate Base	1	1	.	.	.	.	.	2
Otter Creek	.	.	.	.	.	.	1	1
Late Archaic/E. Woodland	2	1	4	.	.	.	.	7
Late Woodland	1	.	.	.	.	.	.	1
SUBTOTAL	7	2	4	.	1	.	1	15
LATE AU								
Palmer	1	.	.	.	.	.	.	1
Kirk Stemmed	.	1	.	.	1	.	.	2
Late Archaic/E. Woodland	.	.	1	.	.	.	.	1
SUBTOTAL	1	1	1	.	1	.	.	4
TOTALS	11	7	6	1	2	1	1	29

quartz (5), argillite (2), and quartzite (1). Several of the bifaces appear to have been used as scrapers and/or knives after they failed (broke) or were rejected (Plate 19). Thirty-four of the 76 finished points were assigned to point types (Table 11) and have already been discussed. The length, width, and thickness of intact points are summarized in Table 12.

Four bifaces deserve special mention because they do not readily fit into the above types. The first specimen is the very large early-stage argillite biface that was recovered from Feature 33. Because of its irregular outline and flaking pattern, it might be more accurate to describe this specimen as a crude bifacial core or as a block of argillite that has been bifacially worked (Plate 18). Given the large size of several of its flake scars, it is possible that large flakes were detached from it to make argillite stemmed points. The last three specimens were classified as "other bifaces" (Table 10): one is a crudely flaked quartzite block that may have functioned as a chopper; the other two are believed to be hoe blades or grubbing tools (e.g., Broyles 1971:figure 32). The intact hoe blade is manufactured from a large quartzite cobble (Plate 20), while the fragmentary example is manufactured from a slab of ironstone and represents the bit end of a hoe blade. That both specimens exhibit some degree of edge rounding and polishing on their bits supports the notion that they were digging tools. An alternative explanation is that they functioned as high-duty scrapers.

b) *Unifaces*

Sixty-six unifaces were recovered: 25 retouched flakes, 24 utilized flakes, 10 endscrapers, 6 sidescrapers, and 1 denticulate (Plates 15-17). Expedient unifaces--utilized flakes and retouched flakes--are the most common and are manufactured from jasper (31), chert (11), chalcedony (2), quartz (1), argillite (1), igneous/metamorphic material (1), and indeterminate material (1). Given the analytical methods that were employed, it is likely that many briefly used flakes were not identified as utilized flakes but were simply recorded as debitage. This detection problem is probably most severe in the quartz assemblage because edge utilization is difficult to detect on quartz. Similar detection problems occur with argillite, but in this case, detection of utilization is hindered by erosion.

TABLE 16: COUNT, WEIGHT, AND MEAN WEIGHT OF RAW MATERIAL TYPSE FOR ALL CHIPPED-STONE ARTIFACT CLASSES BY ANALYTICAL UNITS

ANALYTICAL UNITS/RAW MATERIALS	Count	Weight	Mean Weight
EARLY AU			
Jasper	1121	695.7	0.6
Chert	488	282.1	0.6
Vein Quartz	438	889.4	2.0
Quartzite	239	1412.5	5.9
Argillite	33	1637.7	49.6
Chalcedony	22	90.9	4.1
Rhyolite	8	0.8	10.0
Crystal Quartz	25	11.9	0.5
Igneous/Metamorphic	10	132.9	13.3
Ironstone	4	0.7	0.2
Indeterminate	50	30.5	0.6
SUBTOTAL	2438	5185.1	2.1
MIDDLE AU			
Jasper	1551	717.4	0.5
Chert	479	282.0	0.6
Vein Quartz	255	300.3	1.2
Quartzite	88	274.2	3.1
Argillite	45	114.3	2.5
Chalcedony	18	19.0	1.1
Rhyolite	9	13.7	1.5
Crystal Quartz	7	1.8	0.3
Igneous/Metamorphic	4	30.9	7.7
Ironstone	6	7.3	1.2
Indeterminate	22	5.8	0.3
SUBTOTAL	2484	1766.7	0.7
LATE AU			
Jasper	569	416.2	0.7
Chert	134	93.8	0.7
Vein Quartz	92	112.1	1.2
Quartzite	28	123.3	0.4
Argillite	5	18.2	3.6
Chalcedony	9	4.0	0.4
Rhyolite	1	1.2	1.2
Ironstone	1	2.5	2.5
Indeterminate	12	4.9	0.4
SUBTOTAL	851	776.2	0.9
GRAND TOTAL	6,085	8,404.1	1.4

Note: all weights expressed in grams.

The endscrapers are manufactured from either jasper (6) or chert (4), and the sidescrapers are manufactured from chert (3), jasper (2), and quartz (1). The denticulate is manufactured from jasper. Based upon their morphology, several of the endscrapers and sidescrapers could belong to the Early Archaic component or to the possible Paleoindian component.

c) *Cores*

The lithic assemblage contains a total of 54 cores, which are divided between three types: 41 bipolar cores, 6 freehand cores, and 7 tested cobbles (Plates 21 and 22). Bipolar cores have the lowest mean weight (5.3 g), followed by freehand cores (22.0 g) and tested cobbles (57.8 g) (Table 18). These differences in weight are expected because the bipolar cores were intensively reduced, and the tested cobbles were rejected from reduction after the removal of several test flakes. Bipolar reduction is a technique for maximizing available raw materials, particularly small cobbles (Flenniken 1981; Hayden 1980). Consequently, the large number of bipolar cores is consistent with raw material scarcity. The tested cobbles are manufactured from jasper (3), chert (2), quartz (1), and quartzite (1); the bipolar cores are manufactured from jasper (21), quartz (13), and chert (7); the freehand cores are manufactured from quartz (3), jasper (1), chert (1), and basalt (1). The basalt

TABLE 17: SUMMARY OF CORTEX TYPES BY RAW MATERIAL FOR THE CHIPPED-STONE ASSEMBLAGE EARLY ANALYTICAL UNIT

		CORTEX TYPE*					
RAW MATERIAL		A	C	B	I	X	TOTAL
Jasper							
	Count	851	254	10	6	.	1,121
	Weight	253.8	423.7	13.8	4.4	.	695.7
Chert							
	Count	398	79	6	5	.	488
	Weight	148.9	75.9	55.8	1.5	.	282.1
Vein Quartz							
	Count	332	102	1	3	.	438
	Weight	311.3	574.9	0.1	3.1	.	889.4
Quartzite							
	Count	207	29	.	3	.	239
	Weight	517.1	889.5	.	5.9	.	1,412.5
Argillite							
	Count	.	.	.	.	33	33
	Weight	.	.	.	.	1,637.7	1,637.7
Chalcedony							
	Count	17	3	2	.	.	22
	Weight	14.4	1.5	75.0	.	.	90.9
Crystal Quartz							
	Count	24	.	1	.	.	25
	Weight	6.3	.	5.6	.	.	11.9
Rhyolite							
	Count	8	.	.	.	.	8
	Weight	0.8	.	.	.	.	0.8
Igneous/Metamorphic							
	Count	4	4	1	1	.	10
	Weight	10.0	88.9	4.1	29.9	.	132.9
Ironstone							
	Count	4	.	.	.	.	4
	Weight	0.7	.	.	.	.	0.7
Indeterminate							
	Count	49	1	.	.	.	50
	Weight	22.6	7.9	.	.	.	30.5
TOTAL	Count	1,894	472	21	18	33	2,438
	Weight	1,285.9	2,062.3	154.4	44.8	1,637.7	5,185.1

* A = absent; C = cobble; B = block; I = indeterminate; X = no observation.

core may actually represent a groundstone celt or axe fragment that was recycled into a core (Plate 22:c).

None of the cores possess block cortex. The dominance of cobble cortex in the core assemblage, as well as in the entire chipped-stone assemblage, and the presence of tested cobbles of jasper, chert, quartz, and quartzite clearly indicate that the inhabitants of the site secured large numbers of cobbles from somewhere on the Delmarva Peninsula. If a sizable deposit of cobbles were located, it is likely that it would--like a primary lithic source--have been exploited at regular intervals because it would have been a predictable source of raw material (see Custer and Galasso 1980). Minor cobble deposits, on the other hand, may have been checked for usable cobbles only when individuals passed by, or stumbled onto, such deposits during the course of other activities (e.g., hunting). Apparently, some cobbles were brought to the site before they were even tested.

d) *Debitage*

The debitage assemblage is made up of 5,840 specimens that have been sorted into eight different types of flakes and shatter (Table 19). Jasper and chert account for 76 percent of the assemblage by count and 46 percent by weight. Each raw material's debitage assemblage has already been discussed in terms of cortex and mean weight. Cortex types are summarized in Table 14. Also, it has been noted that the debitage assemblage undoubtedly contains flakes and pieces of shatter that were used as expedient tools.

The jasper assemblage includes 198 decortication flakes, 830 early-reduction flakes, 20 bipolar flakes, 716 biface-reduction flakes, 1,298 flake fragments,

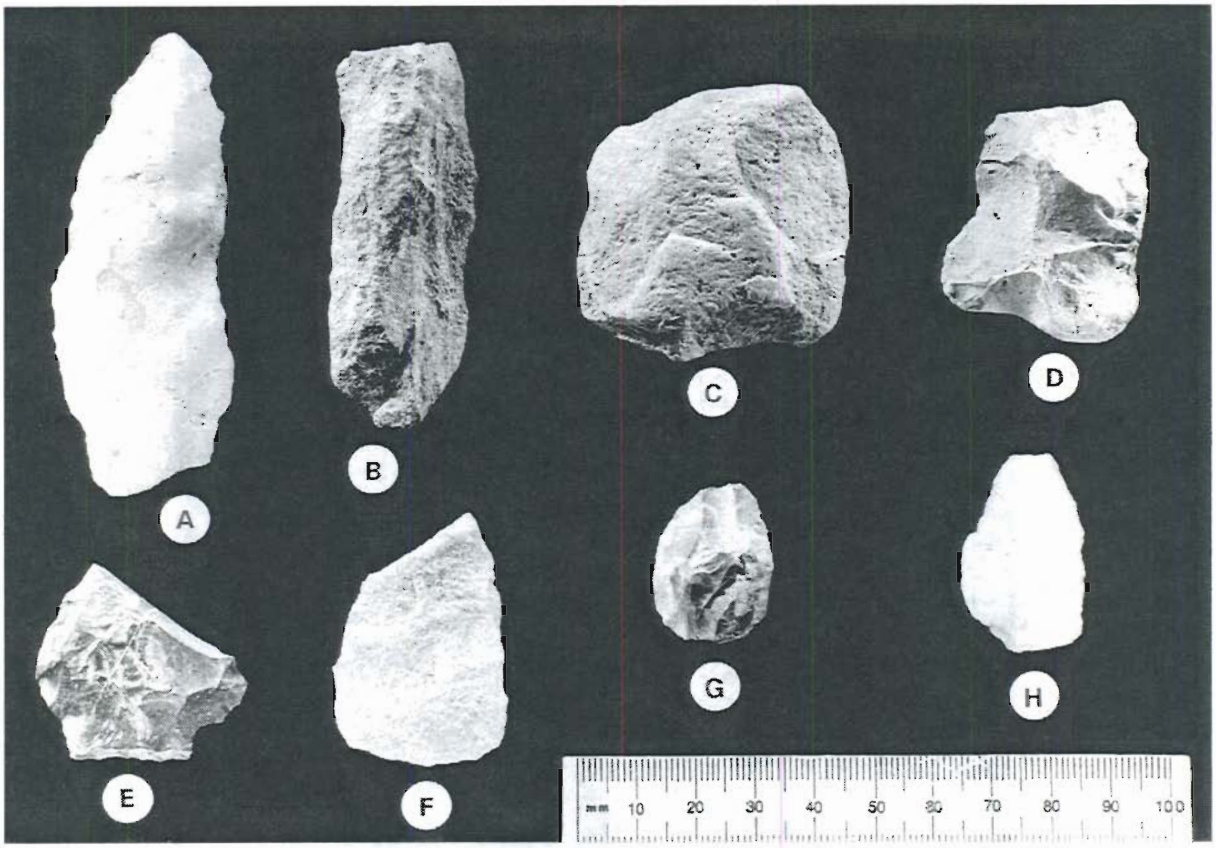


PLATE 19: Assorted Bifaces. A: Middle Stage Biface, Quartz, Cat. No. 50 (Test Unit 1, Stratum B, Level 7); B: Indeterminate Biface, Schist, Cat. No. 550 (Excavation Unit 21, Stratum B, Level 3); C: Middle Stage Biface, Argillte, Cat. No. 297 (Excavation Unit 28, Stratum B, Level 4); D: Early Stage Biface, Jasper, Cat. No. 886 (Excavation Unit 45, Stratum B, Level 5); E: Late Stage Biface, Jasper, Cat. No. 177 (Excavation Unit 16, Stratum B, Level 4); F: Late Stage Biface, Quartzite, Cat. No. 554 (Excavation Unit 21, Stratum B, Level 4); G: Middle Stage Biface, Possible Scraper, Jasper, Deer Family-Level Blood Residue, Cat. No. 68 (Test Unit 5, Stratum B, Level 6); H: Indeterminate Biface, Quartz, Deer Family-Level Blood Residue, Cat. No. 926 (Excavation Unit 40, Stratum B, Level 2).

176 pieces of block shatter, and 50 pieces of flake shatter. The relationship between these different types is expressed as percentages and is graphically presented in Figure 16a. The nearly equal numbers of early-reduction flakes and biface-reduction flakes indicate that, in addition to some level of flake-tool production, both biface production and maintenance (resharpening) were common activities. Similar patterns are evident in the chert assemblage (Table 19 and Figure 16b). The quartz assemblage differs in its lower number of biface flakes and its greatly increased number of pieces of block shatter (Figure 16c). These differences are products of their differing fracture mechanics--that is, quartz shatters more readily than chert and jasper. In addition, it is likely that quartz was more frequently used for flake-tool production than for biface production. But only a limited number of quartz unifaces were identified. This discrepancy, however, can be partly explained by how difficult it is to detect use-wear on quartz flakes. The quartzite assemblage differs from the other three raw material assemblages in that it possesses large numbers of early-reduction flakes (Figure 16d), a pattern that suggests both flake-tool production and early- to middle-stage biface production.

Rhyolite is represented only by biface flakes and flake fragments, while argillite is represented by these types and by early-reduction flakes (Table 15). The latter flakes are seen as support for the notion that argillite was procured under different circumstances than rhyolite (i.e., exchange versus embedded procurement).

e) *Groundstone Tools*

The only definite groundstone tool recovered is a tiny piece of steatite (0.7 g) that was once part of a stone

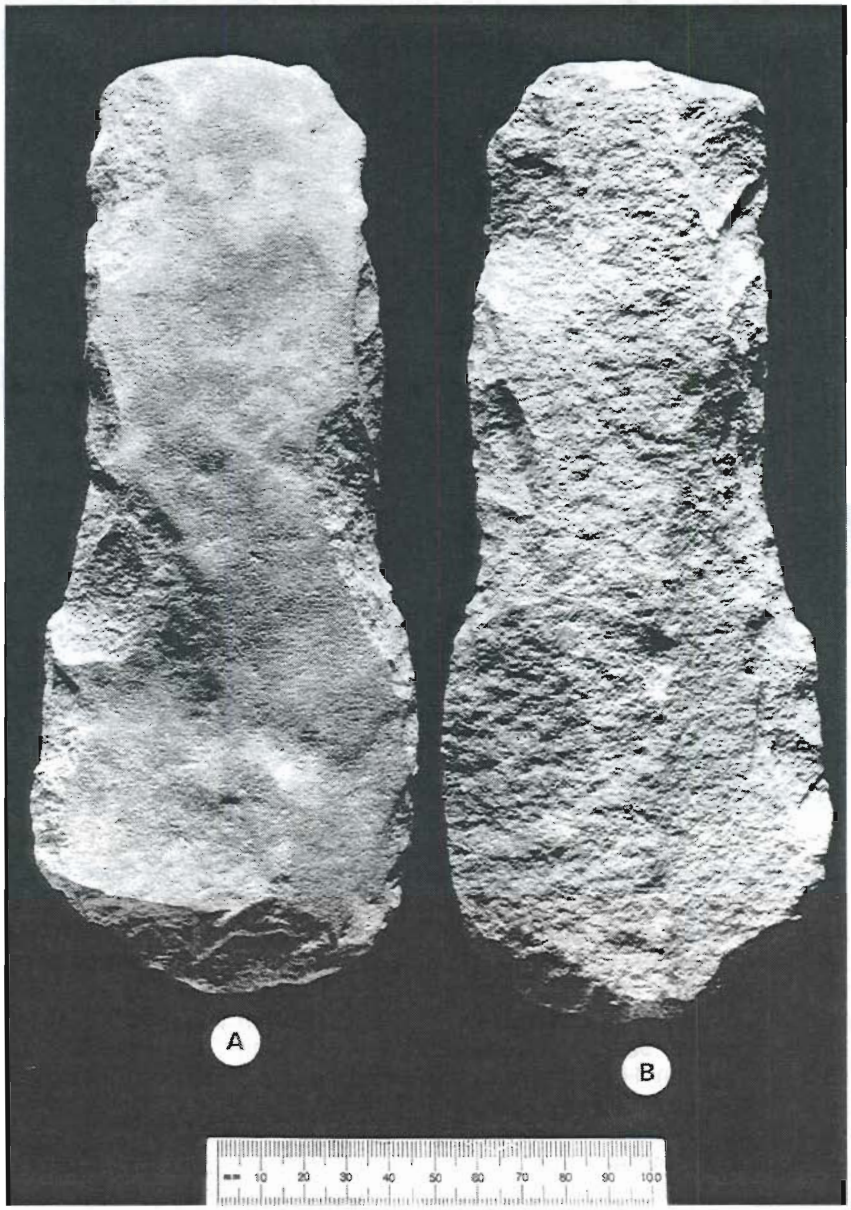


PLATE 20: Hoe Blade, Quartzite, Cat. No. 541 (Excavation Unit 48, Feature 21). A: Obverse; B: Reverse.

vessel or some type of ornament. A possible groundstone tool is the previously discussed freehand core that may be a recycled celt or axe.

f) *Cobble Tools*

Seventeen cobble tools were recovered: 1 abrader, 1 metate, 1 anvilstone, 2 pestles, 2 manos, 2 pitted cobbles, 7 hammerstones, and 1 cobble that may have been used as a chopper. The majority of these simple tools are made from quartzite cobbles, and it is likely that these cobbles were collected from the same deposits as those of the chert and jasper cobbles used in chipped-stone tool production. Cobble tools not made from quartzite include a sandstone abrader, a siltstone pestle, a basalt metate, and a quartz hammerstone. Most of these cobbles were probably collected from the same deposits as the quartzite cobbles (e.g., Plate 23), except for the two largest tools, the basalt metate and the siltstone pestle (Plates 24 and 25). These tools may have been brought to the site from sources near the Fall Line because it is uncertain if cobbles of this size are available on the Delmarva Peninsula.

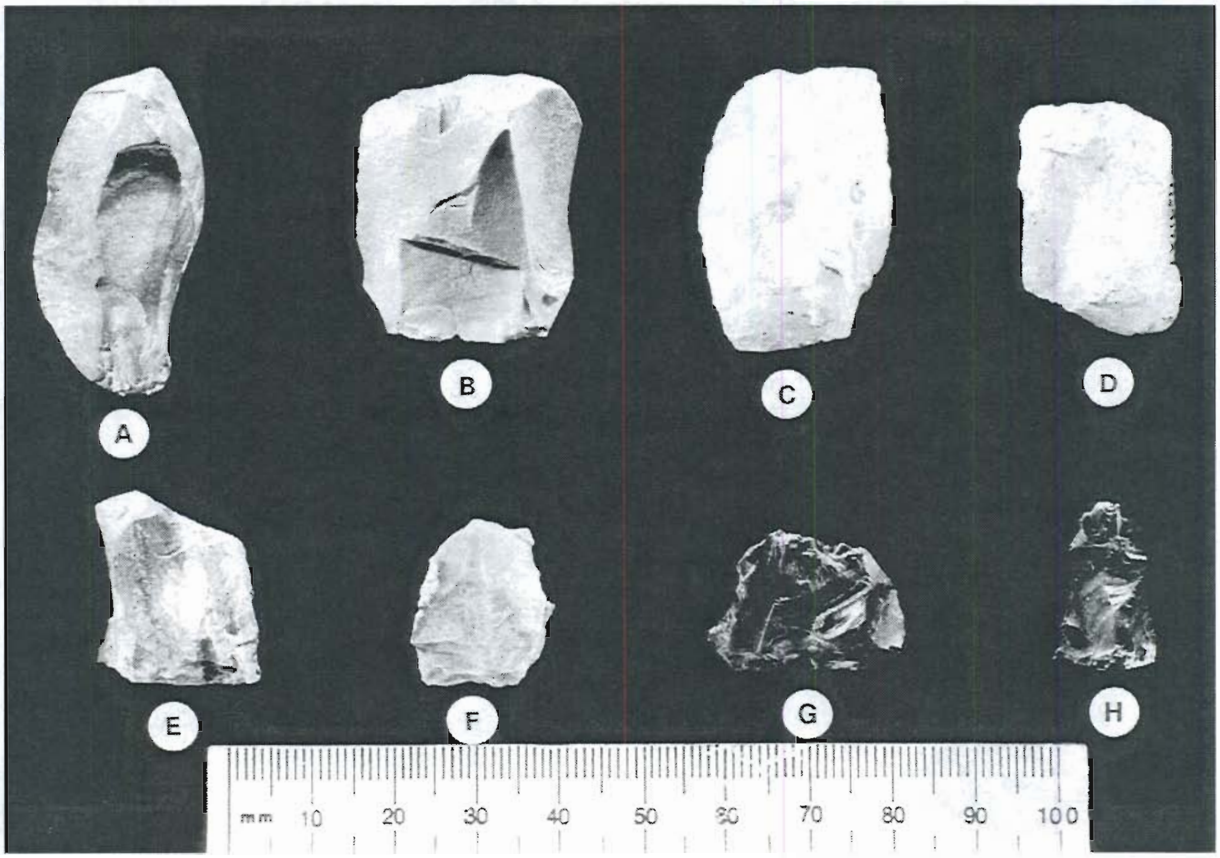


PLATE 21: Bipolar Cores. A: Jasper, Cat. No. 48 (Test Unit 1, Stratum B, Level 5); B: Jasper, Cat. No. 678 (Excavation Unit 31, Stratum B, Level 4); C: Quartz, Cat. No. 49 (Test Unit 1, Stratum B, Level 6); D: Quartz, Cat. No. 727 (Excavation Unit 49, Stratum B, Level 5); E: Chert, Cat. No. 99 (Test Unit 9, Stratum B, Level 2); F: Jasper, Cat. No. 1114 (Excavation Unit 18, Feature 8); G: Jasper, Cat. No. 114 (Test Unit A, Stratum A, Level 1); H: Chert, Cat. No. 592 (Excavation Unit 27, Stratum B, Level 2).

Two cobble tools found in close association (Feature 22) may represent a plant processing unit, a mano (Plate 25:a) and a metate (Plate 24). Eight cobble tools clearly served several functions (e.g., Plates 23-24), and two cobble tools were used as cooking and heating stones and thus ended up as cracked cobbles in the FCR assemblage (Plate 26). That cobbles served several functions and were recycled into cooking stones is seen as additional evidence of the paucity of lithic raw materials in the site area.

g) *Cracked Rock*

Recovered from the site were 273 pieces of cracked rock, weighing a total of 6,222.6 g, with a mean weight of 22.8 g. The vast majority of the specimens are fragments of quartzite cobbles that clearly represent FCR. As already mentioned, the refitting of FCR pieces has documented that cobble tools were used along with unmodified cobbles as cooking and heating stones. The cobbles used in cooking and heating were procured from the same deposits as the other cobbles in the assemblage. Two cobble tools were partially reconstructed from fire-cracked fragments (Plate 26). These two specimens are not included in the cobble tool totals above. Other examples of refitted FCR are shown in Plate 27.

h) *Minerals*

The mineral assemblage includes 33 unmodified specimens: one tiny fragment of hematite or red ocher (0.1 g), one tiny fragment of mica (0.1 g), and 31 fragments of petrified or silicified wood, with a total weight of 64.0 g and a mean weight of 2.1 g. These materials are either natural inclusions in the site's sediments or were brought to the site by its inhabitants. The number of wood pieces may indicate that they were intentionally collected, probably from cobble deposits.

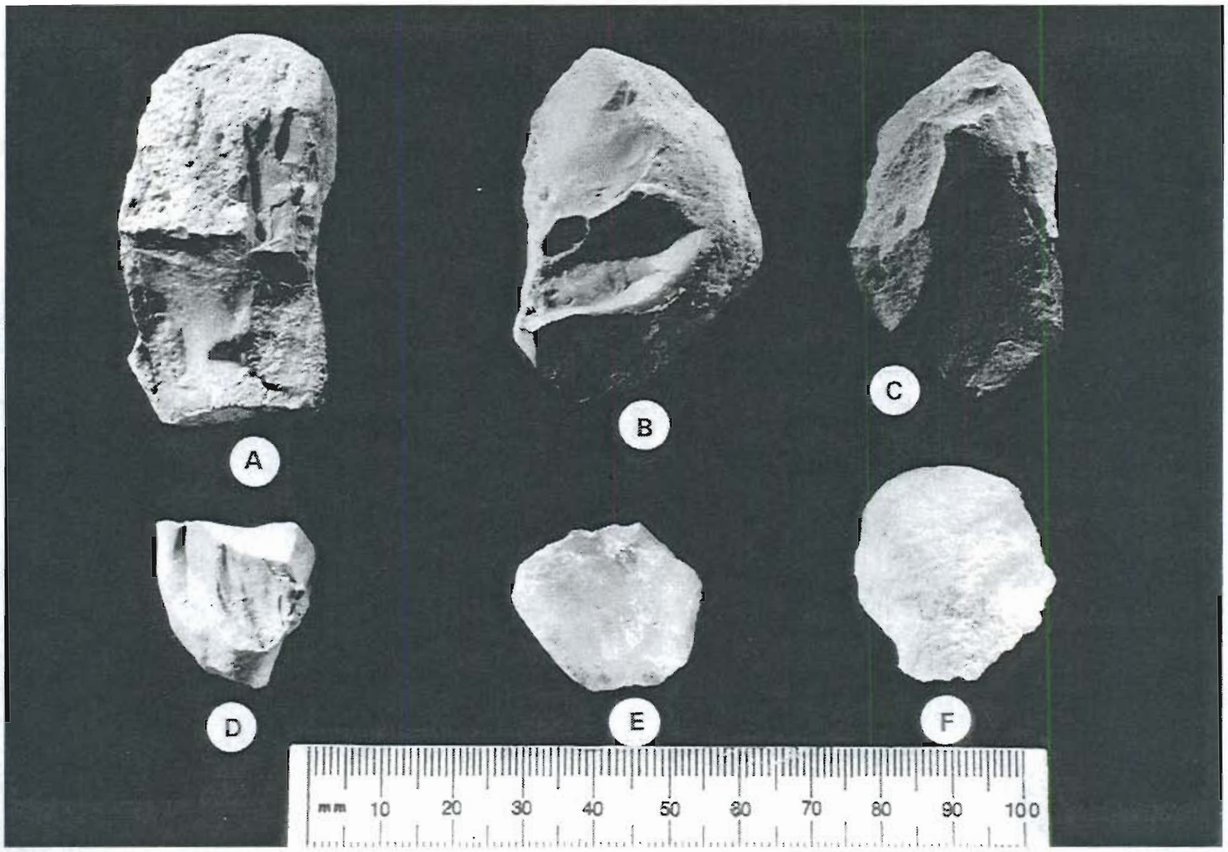


PLATE 22: Tested Cobbles and Freehand Cores. A: Tested Cobble, Jasper, Cat. No. 617 (Excavation Unit 27, Wall Collapse); B: Tested Cobble, Jasper, Cat. No. 693 (Excavation Unit 37, Stratum A, Level 1); C: Freehand Core, Possible Recycled Celt, Basalt, Cat. No. 82 (Test Unit 6, Stratum C, Level 8); D: Freehand Core, Chert, Cat. No. 544 (Excavation Unit 21, Stratum A, Level 1); E: Freehand Core, Quartz, Cat. No. 992 (Excavation Unit 52, Stratum B, Level 4); F: Freehand Core, Quartz, Cat. No. 976 (Excavation Unit 46, Stratum B, Level 8).

2. *Industries and Activities Through Time*

The lithic assemblage, in total, represents a limited range of activities, predominantly subsistence-related activities. Most of the bifaces and unifaces were used in hunting and associated processing tasks; most of the cobble tools were used in the processing of plant foods; the cores and debitage are wastage from tool production and maintenance; the FCR represents the remains of cooking and heating facilities; and the pottery sherds are fragments of Late Woodland containers used for cooking and storage (or transport). The absence or near absence of ornaments and additional tool types, such as drills, gravers, and axes or celts, supports the argument that the site was never more than a temporary campsite. Throughout much of prehistory, groups temporarily "set-up shop" at the site, probably because they were in the area for hunting and/or plant collecting (or possibly plant cultivation).

Even though there is evidence of mixing, there are basic similarities in tool and debris types between the Early, Middle, and Late AUs (Table 20). There are also some important differences: first, the absence of pottery in the Early AU supports the notion that this unit contains a limited number of intrusions from later components; second, there are greater numbers of cores, cobble tools, and FCR in the Early AU than in the Middle and Late AUs. This pattern is taken as evidence for more tool production, more plant processing, and more cooking and heating activities by the Early Archaic component. When this interpretation is coupled with the fact that there are more diagnostic points assigned to the Early Archaic component than any other component, it can be concluded that the site was used most intensively by Early Archaic groups.

In terms of lithic industries, the same basic types of tools were manufactured, used, and maintained over the course of the site's history: small to moderate-sized bifaces, formal and informal unifaces, and simple cobble tools. The only remarkable differences are in raw material selection, which have already been

Table 18: Summary of Cores

RAW MATERIAL	CORE TYPE: TESTED COBBLE	FREEHAND	BIPOLAR	TOTAL
JASPER				
Count	3	1	21	25
Total Weight	145.2	15.9	110.9	272.0
Mean Weight	48.4	15.9	5.3	10.9
QUARTZ				
Count	1	3	13	17
Total Weight	156.2	74.6	76.8	307.6
Mean Weight	156.2	24.9	5.9	18.1
CHERT				
Count	2	1	7	10
Total Weight	24.0	11.5	30.3	65.8
Mean Weight	12.0	11.5	4.3	6.6
QUARTZITE				
Count	1	.	.	1
Total Weight	79.3	.	.	79.3
Mean Weight	79.3	.	.	79.3
IGNEOUS/ METAMORPHIC				
Count	.	1	.	1
Total Weight	.	29.9	.	29.9
Mean Weight	.	29.9	.	29.9
TOTAL				
Count	7	6	41	54
Total Weight	404.7	131.9	218.0	754.6
Mean Weight	57.8	22.0	5.3	14.0

Note: all weights expressed in grams.

discussed, and the appearance of ceramic containers during the Late Woodland occupation.

3. *Site Patterning*

a) *Methodology*

This section examines the internal patterning of the site, focusing on the spatial distribution of lithic raw materials, artifact types, and features. Analysis of the site structure focuses not only on the identification and spatial delineation of activity areas, but also must address the closely related issue of site formation processes. Given the lengthy period of prehistory during which the site was repeatedly used, and its relatively shallow depth, there is no doubt that many different activities were carried out within the same relatively restricted space. Notwithstanding the preservation of features in subsoil contexts, the mixing of material related to different occupational periods and their associated activities has occurred, although there is evidence that the deposits are stratigraphically ordered. While some episodes of site use may have been quite restricted spatially, the total succession of occupational episodes has produced a complex of overlapping deposits.

Identification of activity areas within the site proceeds from the basic assumption that patterning in the archaeological record reflects patterns of cultural behavior. It is known that there are many processes that result in post-depositional displacement of artifacts from their discard location, distorting of the original patterns of discard that would have been visible when artifacts first entered the archaeological record as a result of loss, discard, or abandonment. During analysis of intrasite patterning, one must be aware not only of natural post-depositional distortions, but also of the various cultural behaviors associated with the disposal of refuse. Schiffer's (1972) classification of primary, secondary, and de facto refuse indicates that material may enter the archaeological record through a broad range of behaviors. In particular, it is important to realize that some items may enter the archaeological record at their location of use (e.g., by loss or abandonment), while other items may be discarded away from their location of use (e.g., by the deposition of refuse away from a habitation area). It cannot be assumed that use locations correspond to discard locations.

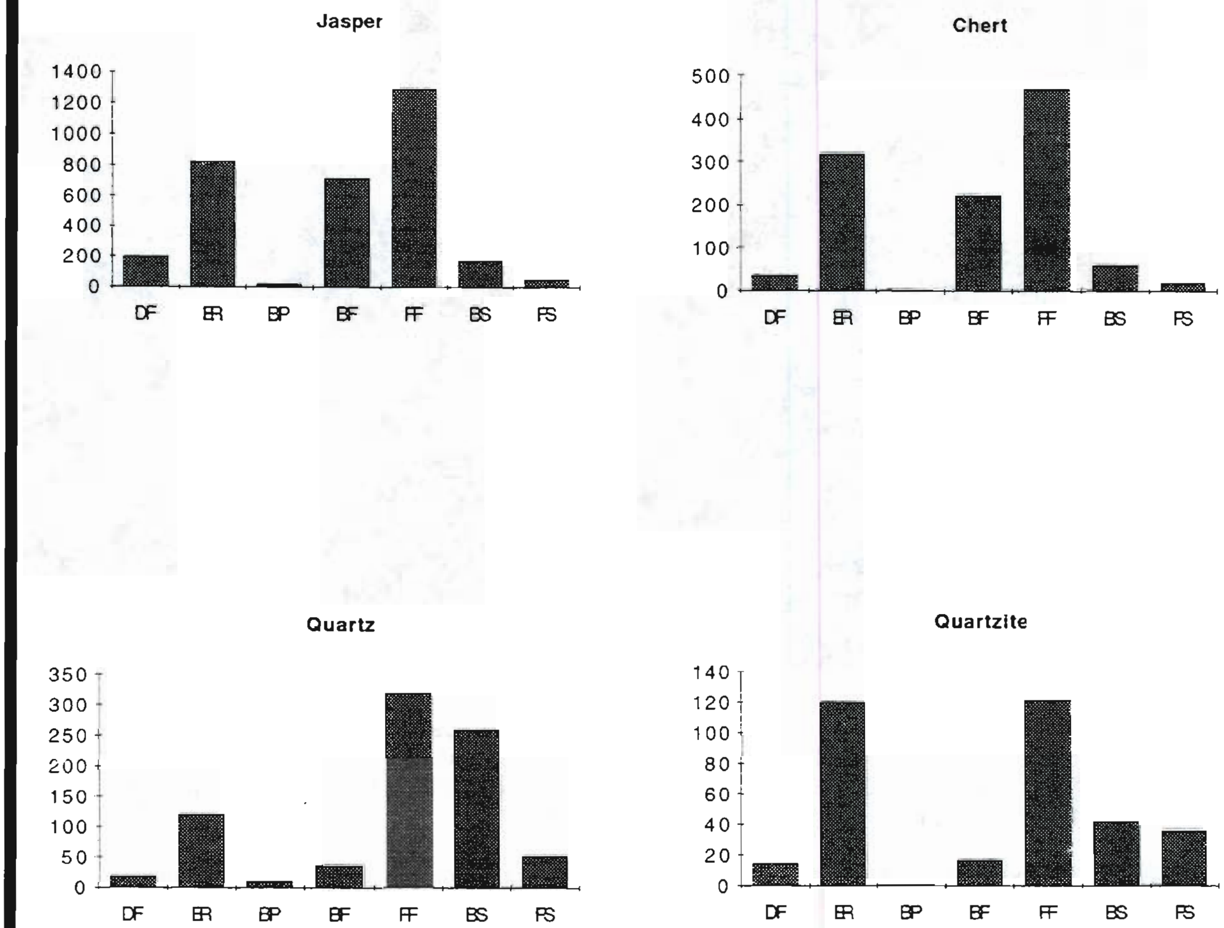
Archaeological features that represent architectural elements or facilities are generally assumed to represent primary or in situ refuse. At Site 7S-F-68, there is

Table 19: Summary of Debitage Types by Raw Material

Raw Material		Debitage Type: DF	ER	BP	BF	FF	BS	FS	IF	Total
Jasper	Count	198	830	20	716	1,298	176	50	.	3,288
	Weight	231.4	311.0	6.7	139.2	354.8	316.7	9.2	.	1,369.0
Chert	Count	36	320	2	223	472	60	21	.	1,134
	Weight	48.6	147.5	1.6	48.8	116.6	161.1	3.3	.	509.4
Quartz	Count	19	121	11	37	321	260	53	.	822
	Weight	39.0	145.9	15.0	14.9	169.9	552.7	15.5	.	952.9
Quartzite	Count	15	120	1	17	122	42	36	.	353
	Weight	74.2	417.9	1.0	11.2	168.7	243.5	11.3	.	927.8
Argillite	Count	.	4	.	5	23	.	.	41	73
	Weight	.	29.2	.	22.0	43.8	.	.	76.2	171.2
Chalcedony	Count	2	16	2	10	15	2	1	.	48
	Weight	38.0	48.5	0.6	1.4	4.0	3.6	0.1	.	96.2
Rhyolite	Count	.	.	.	10	6	.	.	.	16
	Weight	.	.	.	5.4	0.6	.	.	.	6.0
Ironstone	Count	1	5	.	1	5	.	.	.	12
	Weight	2.5	4.4	.	0.2	3.5	.	.	.	10.6
Igneous/Metamorphic	Count	2	5	.	.	3	.	.	.	10
	Weight	30.8	14.7	.	.	3.9	.	.	.	49.4
Indeterminate	Count	1	20	.	5	47	1	10	.	84
	Weight	0.5	9.6	.	0.8	14.4	6.7	2.4	.	34.4
TOTAL	Count	274	1,441	36	1,024	2,312	541	171	41	5,840
	Weight	465.0	1,128.7	24.9	243.9	880.2	1,284.3	41.8	76.2	4,145.0

Debitage types: DF = decortication flake; ER = early reduction flake; BP = bipolar flake; BF = biface reduction flake; FF = flake fragment; BS = block shatter; FS = flake shatter; IF = indeterminate.

little or no direct evidence of the construction of permanent or semi-permanent shelters or habitation structures. Features identified at the site include a group of 11 informal cooking/heating areas represented by charcoal concentrations, three clusters of tools that represent either tool caches or activity areas, and one cooking/heating area represented by a scatter of FCR, charcoal, and discolored soil (see Chapter V). The single FCR feature (Feature 31) may represent a relatively formal cooking/heating area, while the others which lack significant amounts of FCR may represent less formal or casual foci for cooking, heating, or processing. Features such as the milling stone complex (Feature 22) and the cobble chopper and hoe (Feature 21) may represent relatively permanent activity areas within the site. While the site lacks direct architectural evidence of shelters or habitation structures, it is assumed that cooking and heating activities were the foci of domestic activity and that most daily cooking and heating tasks would have been carried out within the principal domestic space occupied by the household or social units that used the site (Binford 1978, 1983; O'Connell 1987; Yellen 1977). Based on these assumptions, the site features are used as points of reference for analysis of the patterning of lithic tools and debris within the site. Figure 6 (end pocket) shows the distribution of features within the site.



DEBITAGE TYPES

DF DECORTICATION FLAKE
ER EARLY REDUCTION FLAKE
BP BIPOLAR FLAKE
BF BIFACE REDUCTION FLAKE
FF FLAKE FRAGMENT
BS BLOCK SHATTER
FS FLAKE SHATTER

FIGURE 16: Frequency of Debitage Types by Count for Jasper, Chert, Quartz, and Quartzite

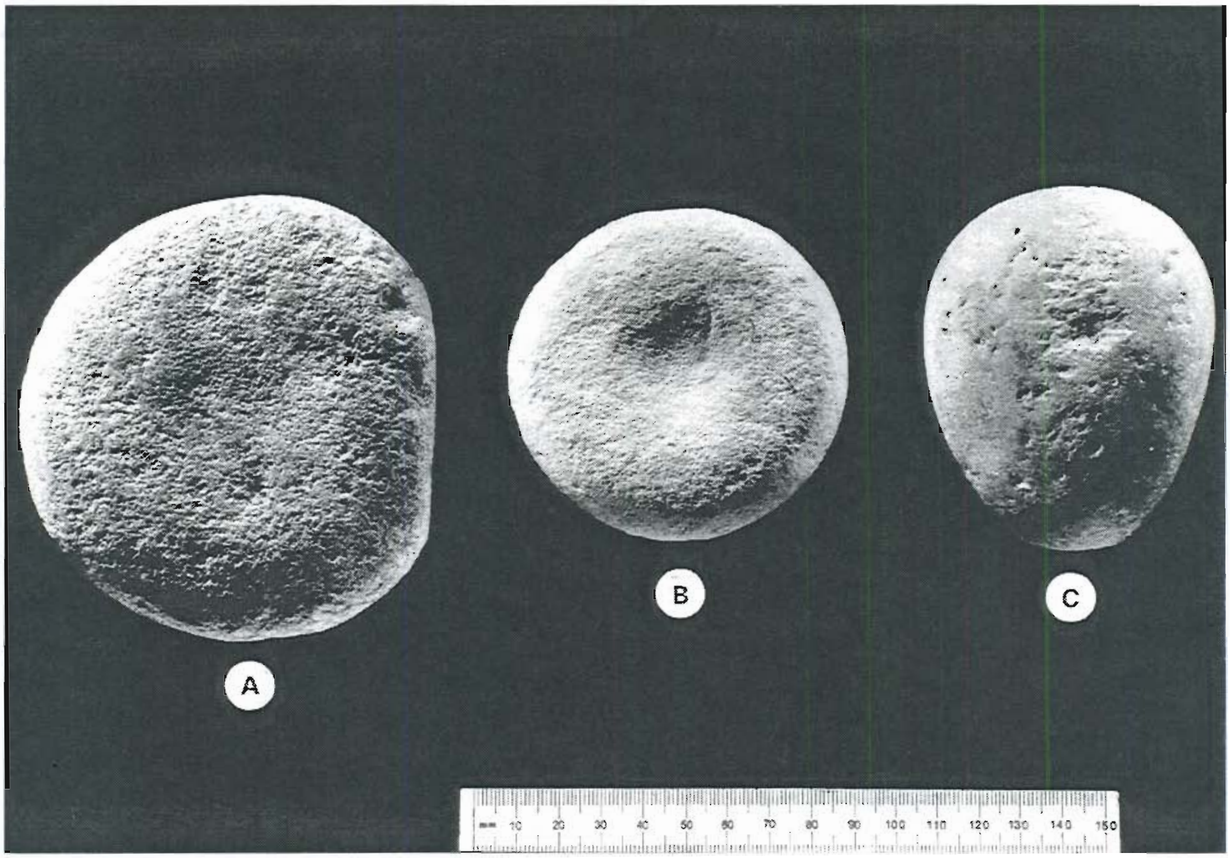


PLATE 23: Cobble Tools, Quartzite. A: Mano, Hammerstone Use, Cat. No. 785 (Excavation Unit 39, Stratum B, Level 4); B: Pitted Cobble, Hammer and Mano Use, Quartzite, Cat. No. 370 (Excavation Unit 35, Stratum B, Level 4); C: Hammerstone, Anvil Use, Quartzite, Cat. No. 1217 (Excavation Unit 57, Stratum B, Level 4).

It is apparent that depositional planes or occupational surfaces have been obscured to a degree that limits analysis of the deposits according to strict vertical provenience. Nonetheless, initial analysis determined that the principal periods of site occupation were represented to a degree within three broad analytical units (AUs) defined according to vertical provenience (see Chapter VI). While these analytical units would presumably include occupational surfaces associated with the site's various occupational episodes, there has also been some mixing of deposits, so that spatial analysis cannot be strictly limited to the analytical units. Given this situation, it is most appropriate to examine the site's internal structure by extending the scope beyond the AUs to include selected elements of the artifact assemblage such as diagnostic projectile points, tools, and raw materials. While there was only limited evidence of vertical stratigraphy, clusters and concentrations of specific artifact types and raw materials were in many cases readily apparent, indicating the presence of horizontally well-defined activity areas, which may be roughly correlated with specific AUs.

The methodology used to examine the site's internal structure involved a combination of computer-assisted statistical techniques and visual examination of manually plotted distribution maps. The lithic artifact classes were used as the principal analytical categories for examination of intrasite patterning. Concentrations of various raw materials were identified from visual examination of density distribution maps for each raw material, which were in turn based on computer summaries indicating the amounts of debitage according to provenience. Definition of specific concentrations was based on the computed mean and standard deviation values for each unit or subsoil quadrant. Initially, some concentrations were plotted by excavation units, followed by plotting of the plowzone and the subsoil quadrants. The plowzone, which corresponds to the Late AU, was plotted by excavation unit, while subsoil concentrations were plotted according to 1x1-meter quadrants within units. In general, the density distributions were highly skewed, and in many cases the mean and standard deviation values were quite close. In most cases, six density ranks were defined, based on the computed mean and

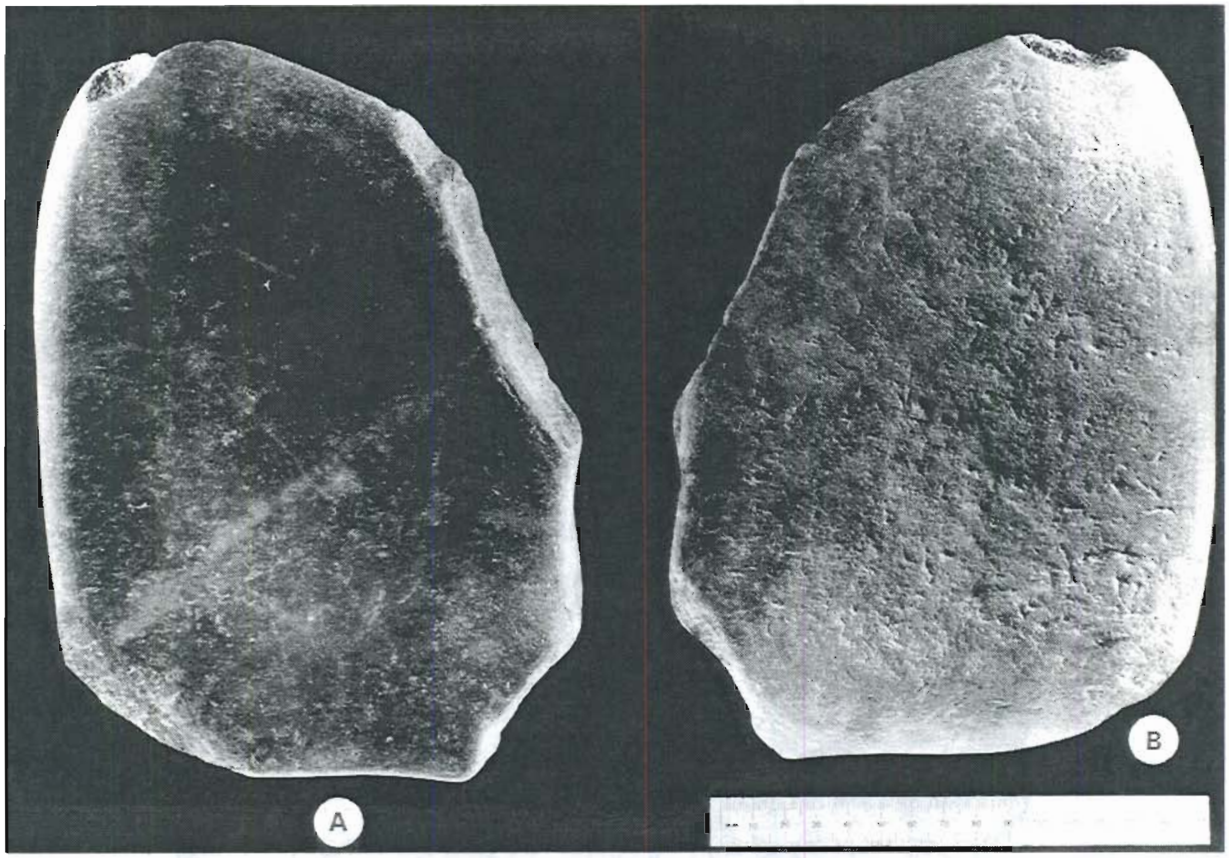


PLATE 24: Metate, Anvil Use, Basalt, Cat. No. 508 (Excavation Unit 42, Feature 22). A: Obverse; B: Reverse.

standard deviation values for each material, with the following cut-off points:

zero
mean - 1/2 standard deviation
mean
mean + 1 standard deviation
mean + 2 standard deviations

Some materials with low overall frequencies could not be plotted with this degree of discrimination. In the following discussion, the terms *low*, *moderate*, and *high* apply to successive gradations along the scale described above; and the term "concentration" is applied to densities greater than the mean plus two standard deviations or to a group of adjacent plotting units with densities more than one standard deviation above the mean. The distribution and clustering of tools were identified by visual inspection of manually plotted distribution maps.

b) *Results*

This section describes the spatial distribution of tools, debitage, and lithic raw materials associated with the various occupational components. The discussion is organized according to chronological units, beginning with the earliest occupation of the site, represented by the Paleoindian and Early Archaic occupations.

A possible Paleoindian component is represented by the recovery of a crystal quartz fluted-point production failure, a crystal quartz point tip, and a possible late Paleoindian lanceolate point made from jasper. Because no other diagnostic artifacts in the assemblage are made from crystal quartz, and because crystal quartz fluted points have been reported from other sites in the surrounding region (Ebright 1992; Peck 1985), it is believed that the entire assemblage of crystal quartz tools and debitage is associated with the fluted-point component at Site 7S-F-68. Crystal quartz debitage is concentrated in the cluster formed by Units 35 and 48 on the western margin of the site, with a few additional pieces recovered from the western part of the North Excavation Block (Figure 17). The fluted-point production failure is also located in Unit 35, while the remaining crystal quartz tool, a biface-reduction flake used as a cutting tool, was recovered from Level 5 of Unit 51 (Figure 18). Of the assignable crystal quartz items, 78 percent were associated with the Early AU, including both tools; the

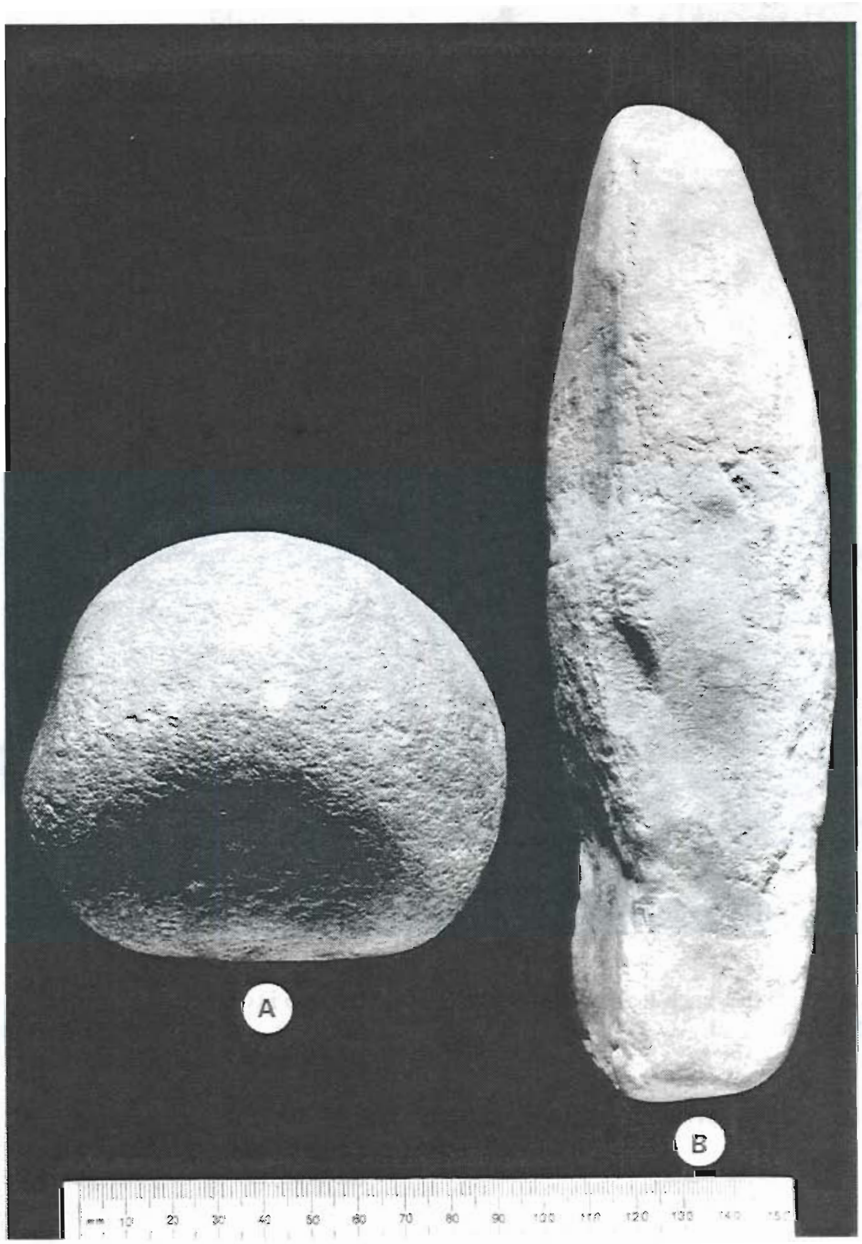


PLATE 25: Cobble Tools. A: Hammerstone, Anvil and Mano Use, Quartzite, Cat. No. 508 (Excavation Unit 42, Feature 22); B: Pitted Cobble, Pestle and Pick, Siltstone, Cat. No. 116 (Test Unit 11, Stratum B, Level 3).

remaining debitage was associated with the Middle AU.

Feature 21, an activity area represented by a cobble chopper and hoe, has been included in the Early AU, and it is within the concentration of crystal quartz identified in Units 35 and 48. This feature is probably associated with the Early Archaic occupation of the site. These tools are not typically associated with Paleoindian tool kits; however, they are often associated with Early Archaic complexes (e.g., Broyles 1971).

Nineteen Early Archaic points were identified in the collection: 1 Palmer, 1 Kirk corner notched, 1 Decatur, 7 Kirk stemmed, 6 bifurcates, and 3 indeterminate fragments. These points are widely distributed over the site, but are most concentrated in the South Excavation Block (Figure 19), where they cluster near Feature 22 (the mano/metate cluster) and Feature 25

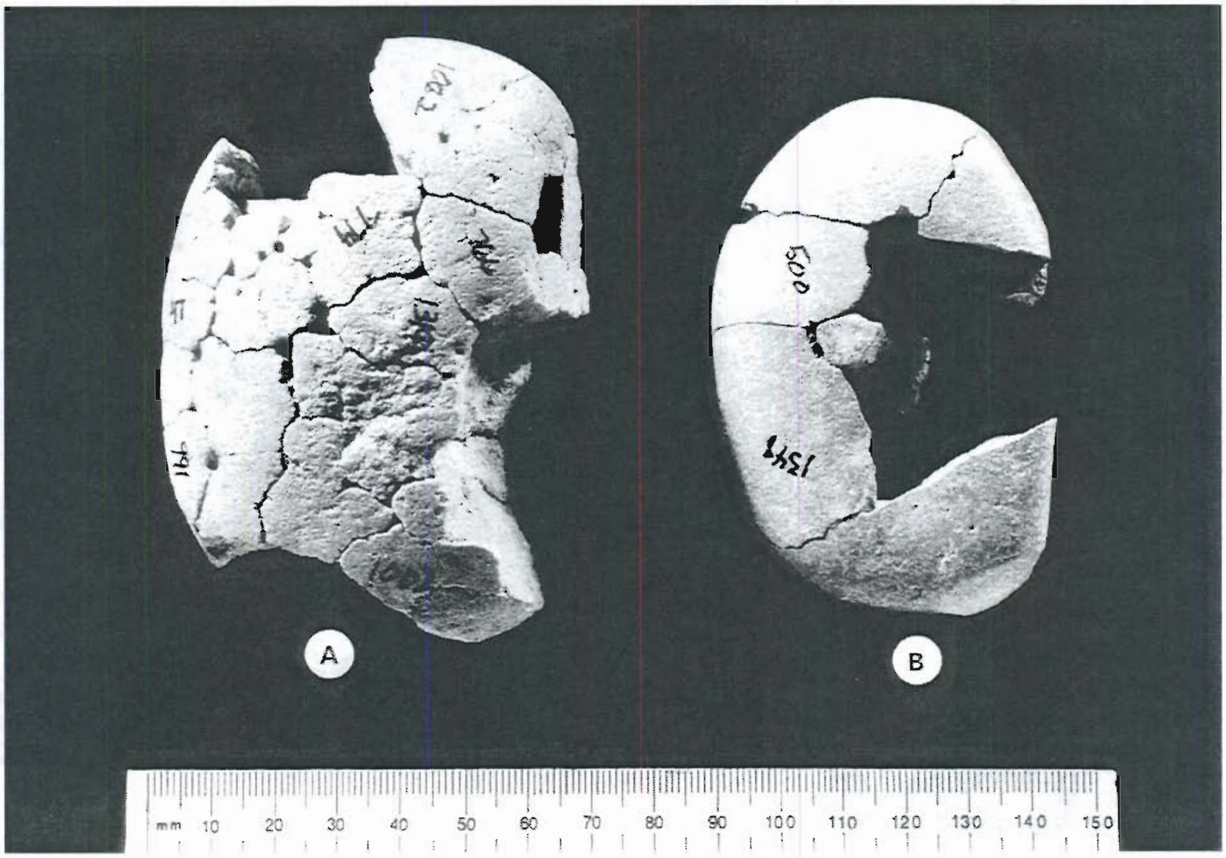


PLATE 26: Refitted Cobble Tools, Quartzite. A: Hammer and Anvil Use, Refit No. FCR-1; B: Hammer Use, Refit No. FCR-3.

(a possible cooking/heating area represented by a small concentration of charcoal). It is also notable that Unit 45 contained the highest number (*N*=4) of Early Archaic points and that the earliest radiocarbon date (7560 $\pm$ 340 years BP; sample # Beta-56049) came from Level 10 of this unit.

Early Archaic lithic procurement patterns show a strong preference for cryptocrystalline materials, as 15 of the 19 points in this group were made from jasper (*N*=8), chert (*N*=6), and chalcedony (*N*=1). Quartz and quartzite are also represented by two examples each. Among these raw materials, quartzite appears to be associated exclusively with the Early Archaic component, as it was used only for production of Kirk Stemmed points, and it was concentrated relatively low in the profile, as measured by raw material frequencies in the excavation levels (see Figure 9). Attribution of quartzite to the Early Archaic component is supported by the fact that the Early AU contained 67 percent of the quartzite by count and 78 percent by weight. The distribution of quartzite debitage in subsoil contexts (Early and Middle AUs) shows a broad distribution across the site, but with a large, distinct concentration in the South Excavation Block. In the Early AU contexts, the concentration of quartzite includes Units 1, 39, 51, and 52, and it is apparently centered on Feature 31, a heating/cooking area represented by a cluster of FCR. High frequencies of quartzite in Early AU contexts were also present in Unit 36, which is adjacent to Feature 31, and in Unit 45, which included the concentration of Early Archaic points. Figure 20 illustrates the distribution of chipped-stone quartzite in the Early AU contexts.

Vein quartz was also used exclusively for Early Archaic points, and this material has the second lowest overall vertical distribution at the site, as measured by artifact counts in the excavation levels. Its spatial distribution in the subsoil levels (Early and Middle AUs) shows three concentrations that closely match the patterns for crystal quartz and quartzite (Figure 21). The highest densities for vein quartz were recovered from the cluster of Units 35 and 48, which also contained the crystal quartz concentration associated with the possible fluted point occupation. Two concentrations of vein quartz were also recovered in the South Excavation Block. The largest of these was in Units 51 and 52, overlapping the quartz concentration focused on Feature 31; a second, smaller concentration of vein quartz was in Units 45 and 46, which is within the largest concentration of Early

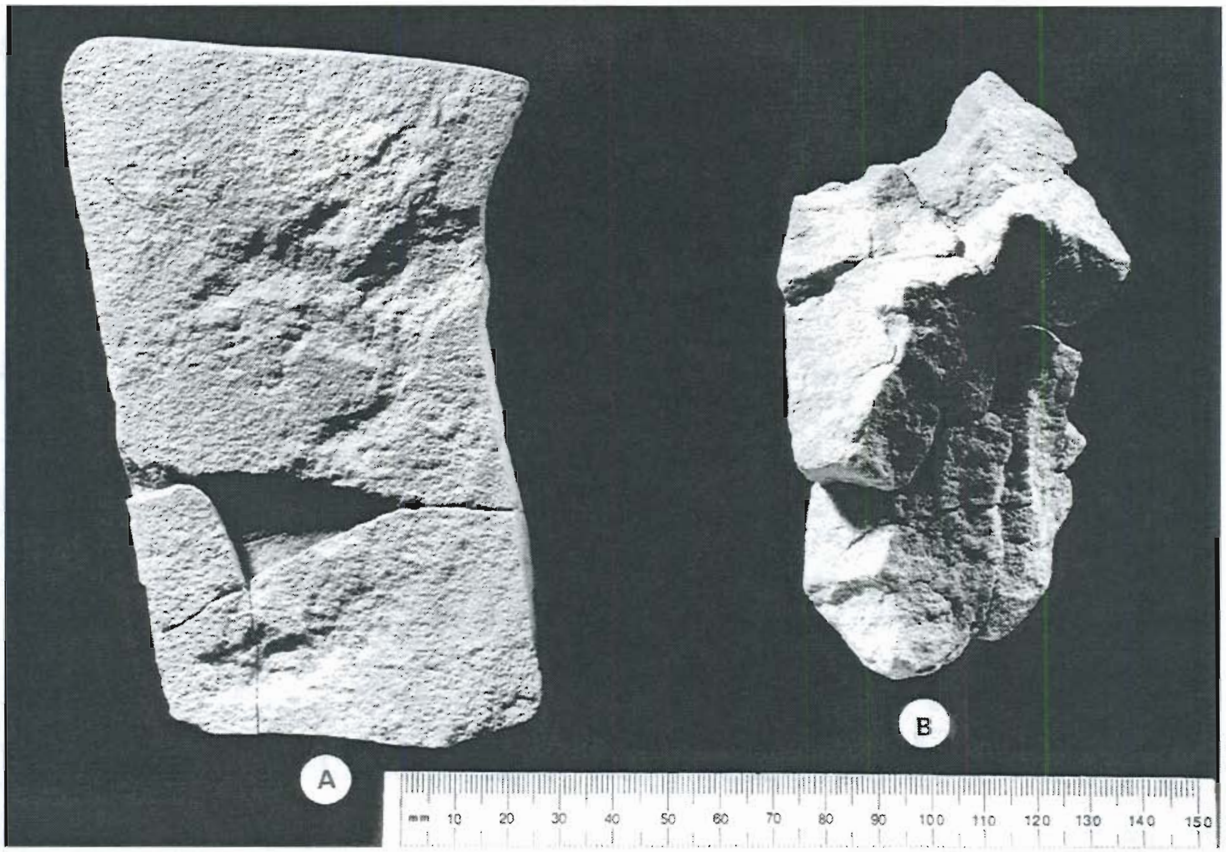


PLATE 27: Refitted Cobbles. A: Quartzite, Refit No. FCR-7; B: Sandstone, Refit No. FCR-14.

Archaic points. One of the Early Archaic quartz points was recovered from an Early AU context in Unit 7, where it appears to be related to the vein quartz concentrations; the other was recovered from an historic dog burial (Feature 1), and therefore its cultural context is uncertain. In addition, the vein quartz tools in the areas of concentration include various bifaces (early-stage, middle-stage, late-stage, and indeterminate), unifacial tools (a retouched flake and a sidescraper), cores, and a hammerstone. The vein quartz tools, like the debitage, are concentrated in the same areas of the site as the vein quartz debitage and the other Early Archaic components (Figure 22). Vein quartz cores are distributed more widely across the site: for example, in the North Excavation Block and the cluster of Units 33, 49, and 57 west of the South Excavation Block. A vein quartz sidescraper recovered from an Early AU context in the North Excavation Block may represent a secondary Early Archaic activity area.

Chalcedony, like crystal quartz, vein quartz, and quartzite, apparently was used only during the Early Archaic, as the one diagnostic point in the assemblage made from this material is a Kirk Stemmed point. Chalcedony accounts for a small fraction of the site's chipped-stone assemblage (2.2%), and the distribution of this material is correspondingly sparse across the site. When analysis is focused on the levels of recovery from excavation units, regardless of analytical units, two concentrations may be identified--one in Unit 14 and the other in Unit 35. Chalcedony was recovered primarily from subsoil contexts (i.e., the Early and Middle AUs), and the spatial distribution of tools and debitage (Figure 23 shows that this material is widely scattered over the northern area of the site. The concentration in Unit 35 overlaps the other early Paleoindian/Early Archaic components represented by crystal quartz and vein quartz, and all of the chalcedony in these units is associated with Early AU contexts. Chalcedony is also broadly distributed across the northwestern sector of the North Excavation Block, with the highest frequencies recovered from Unit 14. In the North Excavation Block, chalcedony was recovered primarily from contexts assigned to the Middle AU. A distinctive procurement pattern for chalcedony is evident in the ratio of block cortex to cobble cortex, as discussed above in Section D. Tools made from chalcedony include two projectile points and two utilized flakes. The one chalcedony point that could be typed (a Kirk Stemmed point) forms part of the cluster of Early Archaic points in Units 45 and 46.

TABLE 20: FREQUENCY OF PREHISTORIC ARTIFACT CLASSES BY ANALYTICAL UNITS

ANALYTICAL UNITS/ARTIFACT CLASS	COUNT	WEIGHT
EARLY AU		
Bifaces	42	2,442.7
Cores	26	438.3
Cobble Tools	11	7,488.9
Debitage	2,349	2,175.3
Cracked Rock	171	3,485.3
Groundstone Tools	0	0
Minerals	31	64.0
Prehistoric Pottery	0	0
Unifaces	21	128.8
SUBTOTAL	2,651	16,223.3
MIDDLE AU		
Bifaces	51	296.2
Cores	12	151.9
Cobble Tools	6	1,542.4
Debitage	2,397	1,210.9
Cracked Rock	72	1,789.2
Groundstone Tools	0	0
Minerals	2	0.2
Prehistoric Pottery	14	17.1
Unifaces	24	107.7
SUBTOTAL	2,578	5,115.6
LATE AU		
Bifaces	19	35.4
Cores	10	98.4
Cobble Tools	0	0
Debitage	807	564.8
Cracked Rock	27	911.5
Groundstone Tools	1	0.7
Minerals	0	0
Prehistoric Pottery	92	153.1
Unifaces	15	77.6
SUBTOTAL	971	1,841.5
GRAND TOTAL	6,200	23,180.4

Note: all weights expressed in grams.

Chert and jasper account for the majority of the Early Archaic points, but the use of these materials is not limited altogether to the Early Archaic. Six of the seven chert points that could be typed were Early Archaic, while the seventh is among the group of 12 Late Archaic/Early Woodland stemmed points. This suggests that chert was one of the most favored raw materials during the Early Archaic, but that its use continued through the Late Archaic/Early Woodland. As one of the most common materials in the assemblage, chert is broadly distributed over the site. The largest concentration of chert occurs in the Early AU contexts, and this concentration spreads across Units 42, 45, and 51 in the South Excavation Block (Figure 24). The spatial concentration of chert in the Early AU is similar to that of quartzite and vein quartz, in that they exhibit the highest frequencies in the western portion of the South Excavation Block, apparently focusing on Features 22, 25, 28, and 31. Chert tools in the Early AU contexts include eight projectile points, two middle-stage bifaces, three indeterminate bifaces, one endscraper, one retouched flake, three utilized flakes, and one bipolar core (Figure 25). Most of these were from contexts associated with the concentration in the South Excavation Block, although a few were from other contexts. What is perhaps most noteworthy about the distribution is that the unifacial tools were mostly recovered from outlying contexts, including three in Unit 23 and one in Unit 49. The majority of the projectile points were from contexts associated with the concentration centered on Feature 31.

Jasper, the most common material in the site assemblage, was apparently the preferred lithic raw material during the Early Archaic, but it was also used during the subsequent Late Archaic/Early Woodland and Late Woodland occupational episodes. The one possible Middle Archaic point was made of jasper, and this example was recovered from an Early AU context. As the most common material in the site assemblage, jasper exhibits a wide distribution throughout the site

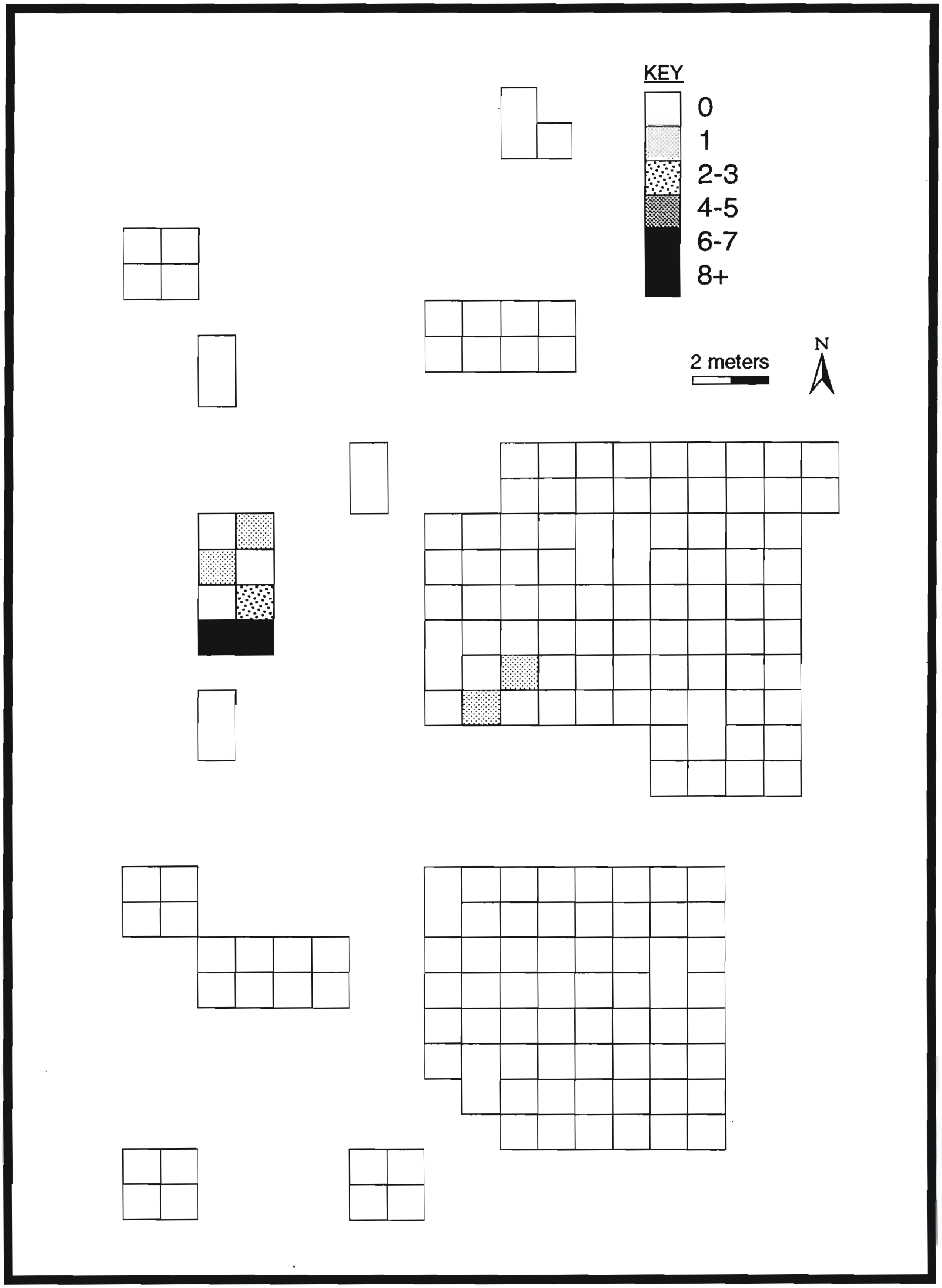


FIGURE 17: Distribution of Crystal Quartz Debitage

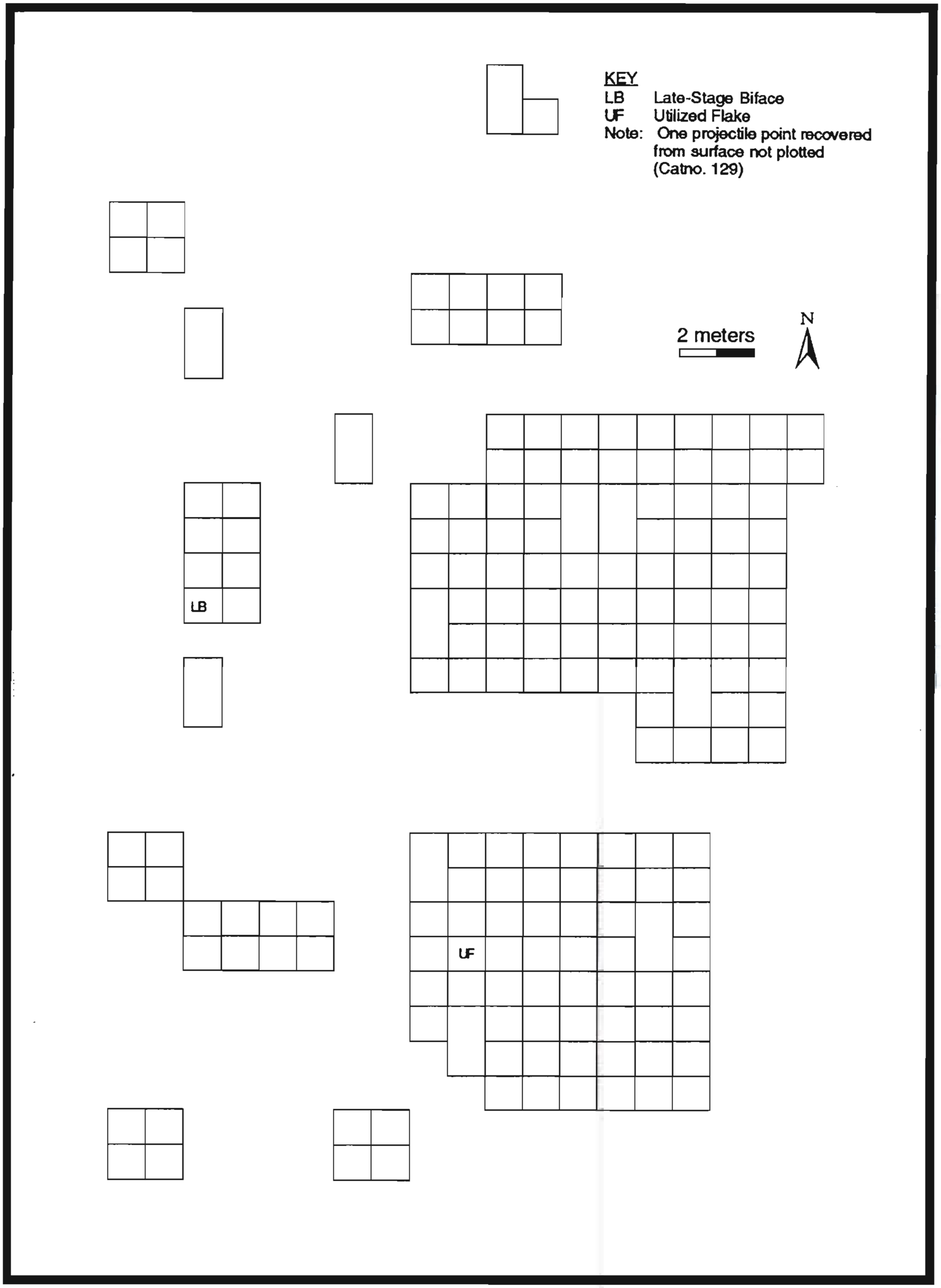


FIGURE 18: Distribution of Crystal Quartz Tools

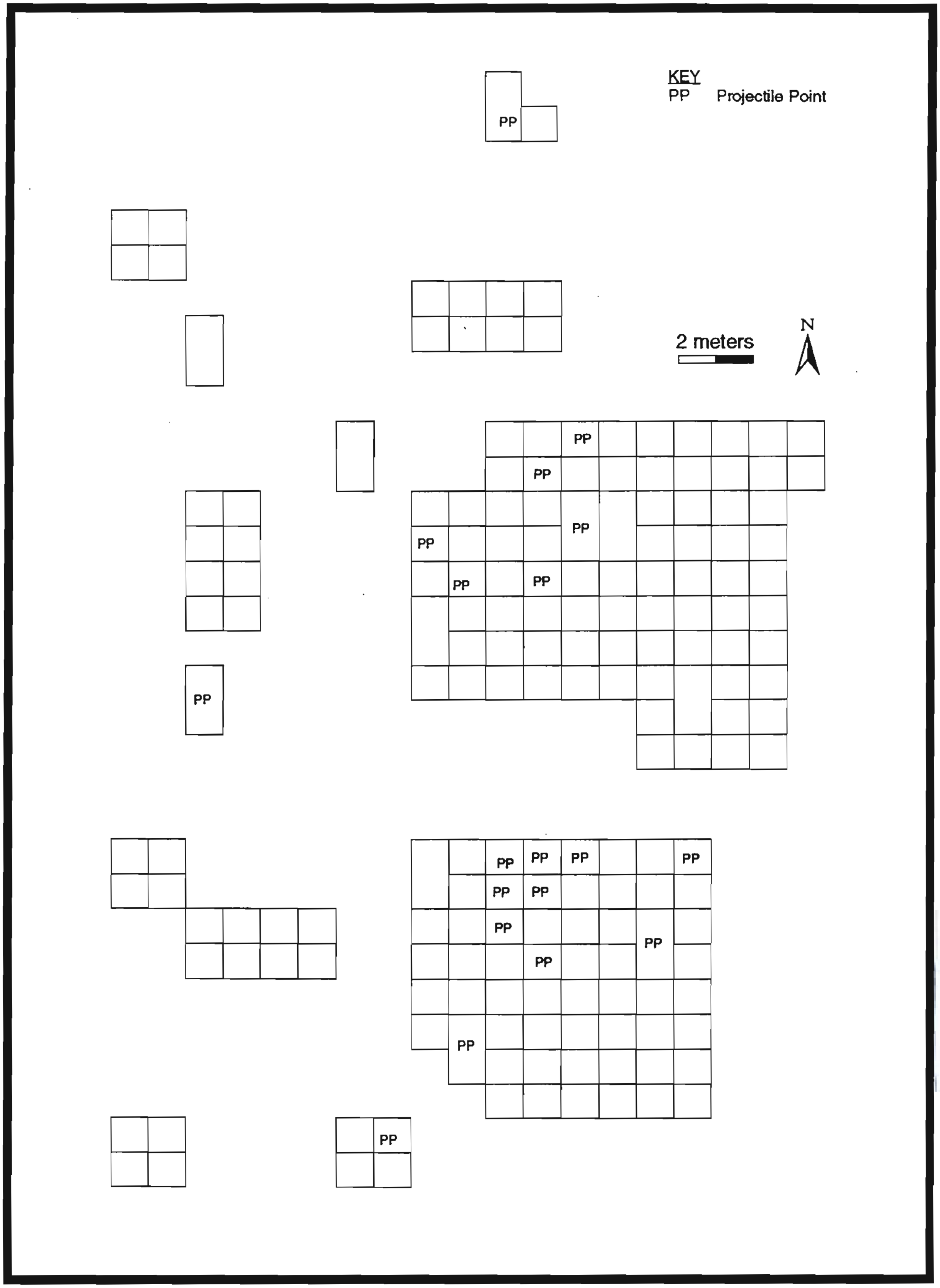


FIGURE 19: Distribution of Early Archaic Points

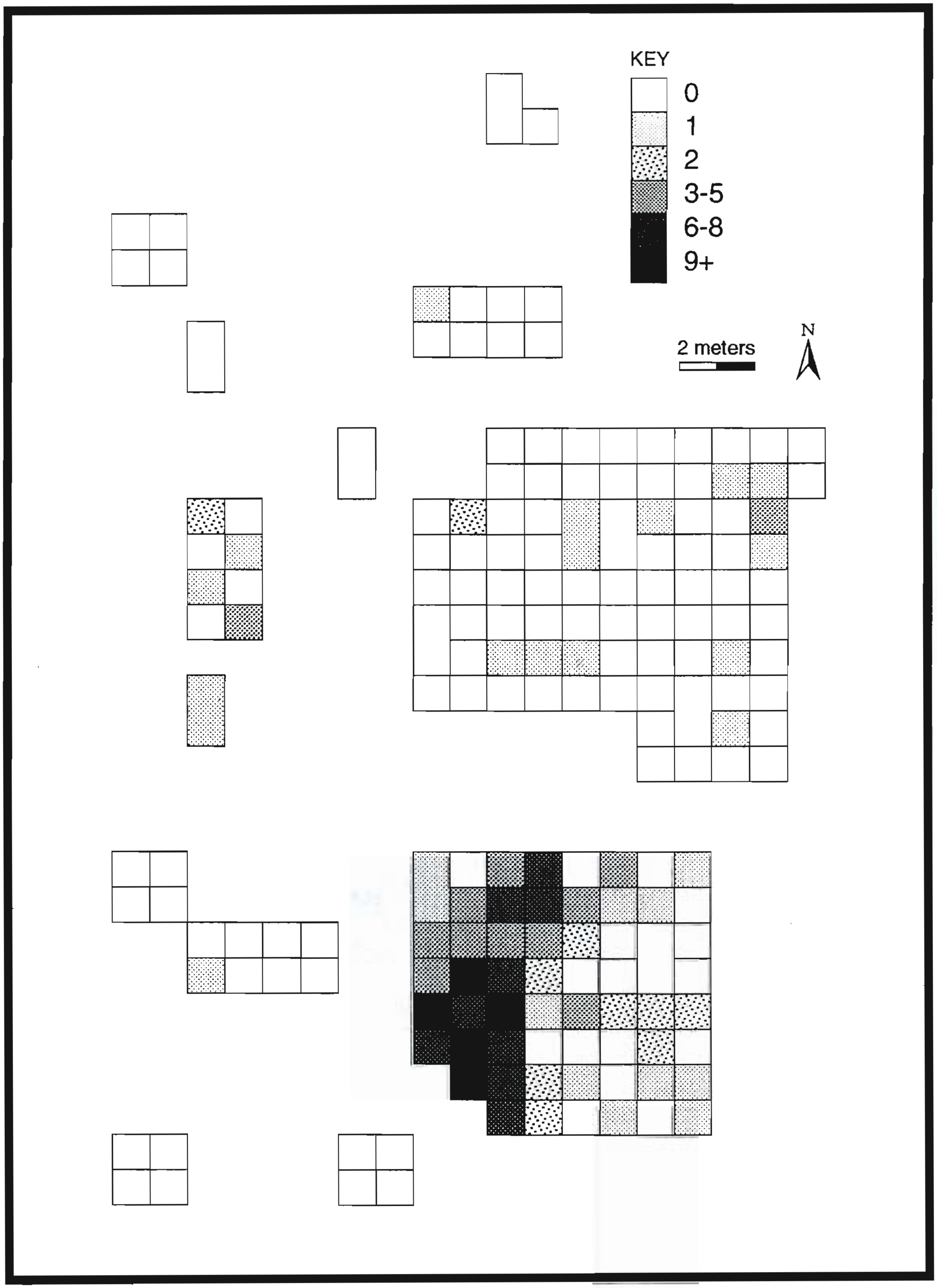


FIGURE 20: Distribution of Quartzite Debitage in Early AU Contexts

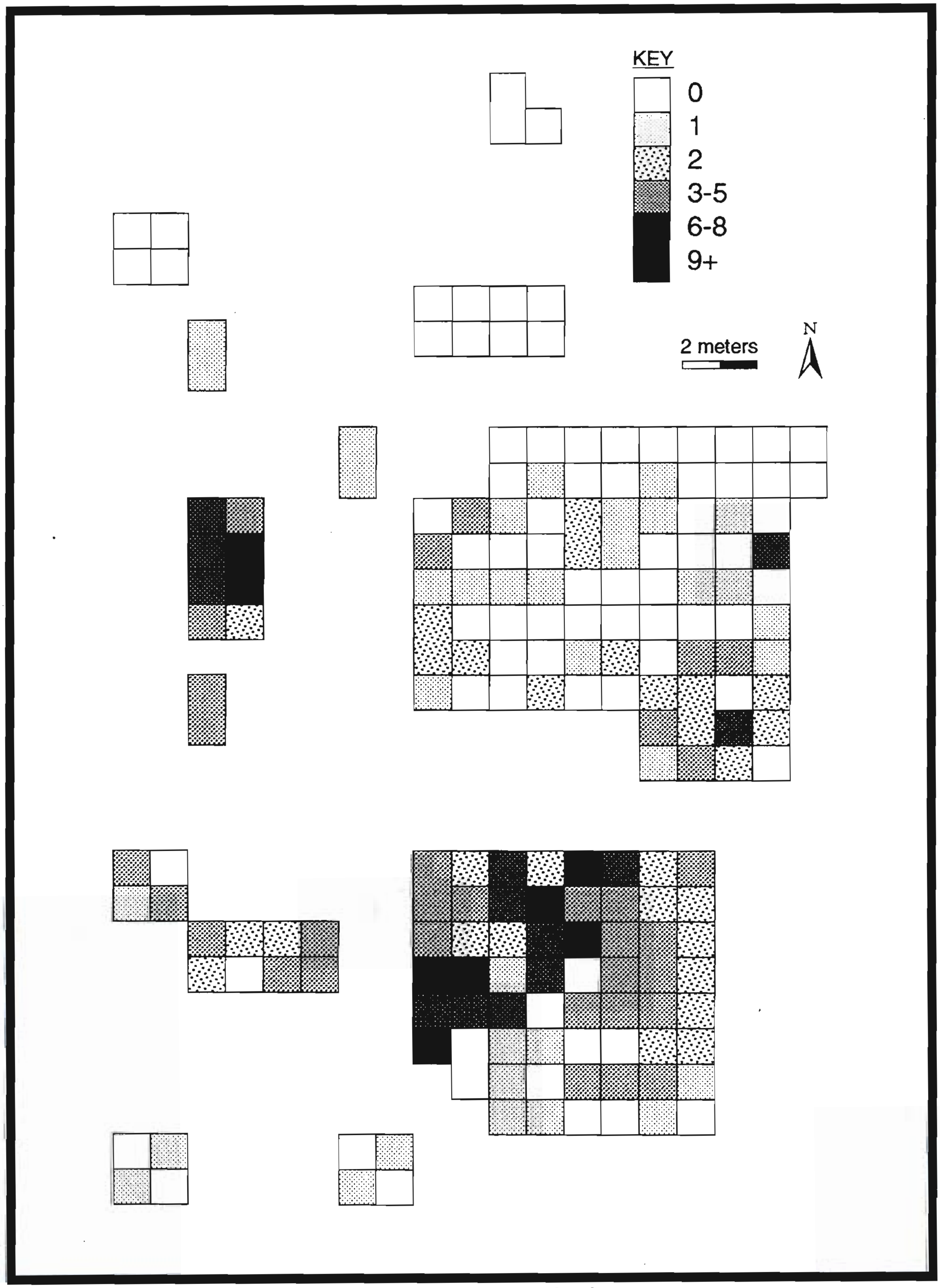


FIGURE 21: Distribution of Vein Quartz Debitage in Early AU Contexts

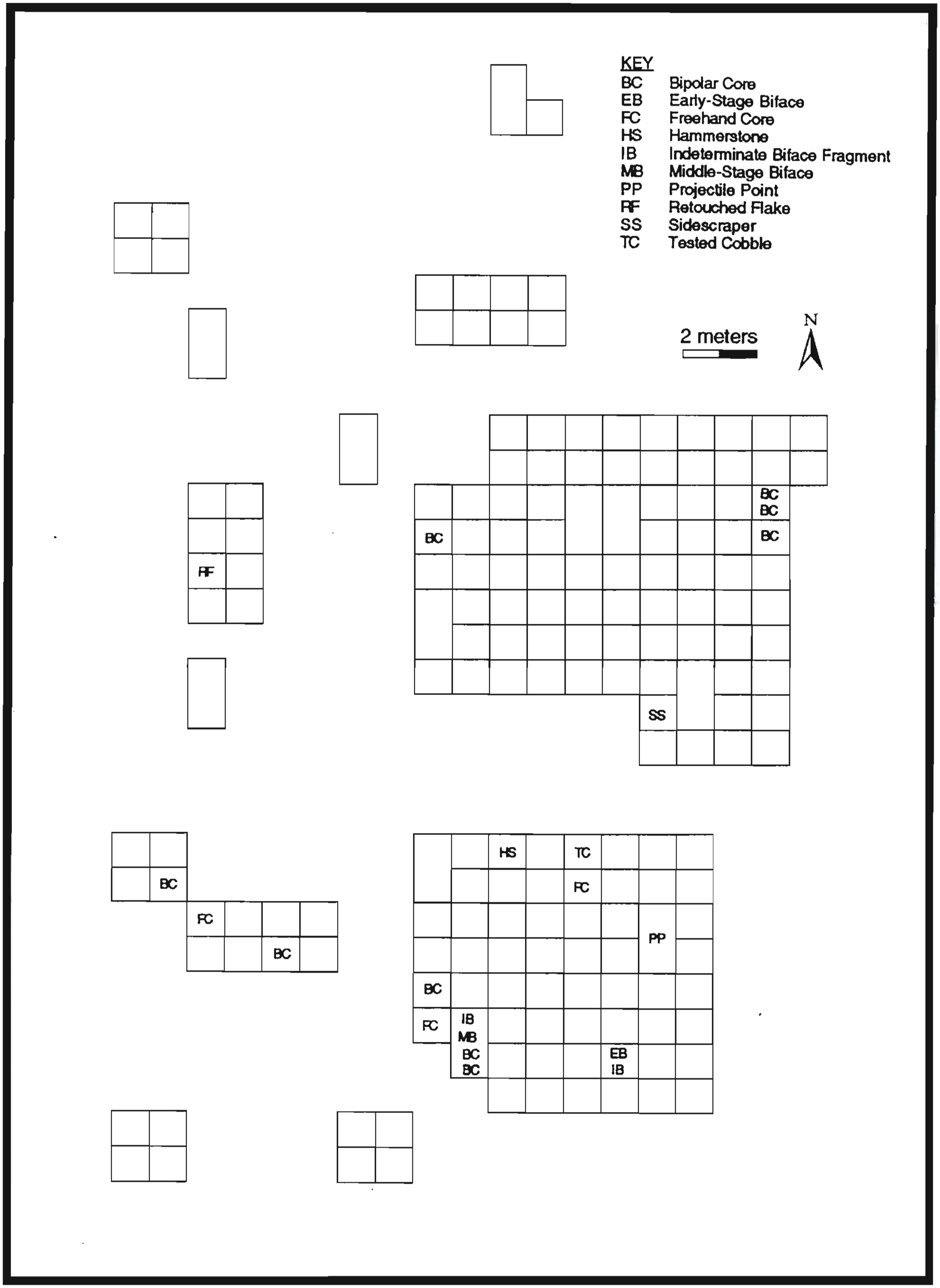


FIGURE 22: Distribution of Vein Quartz Tools in Early AU Contexts

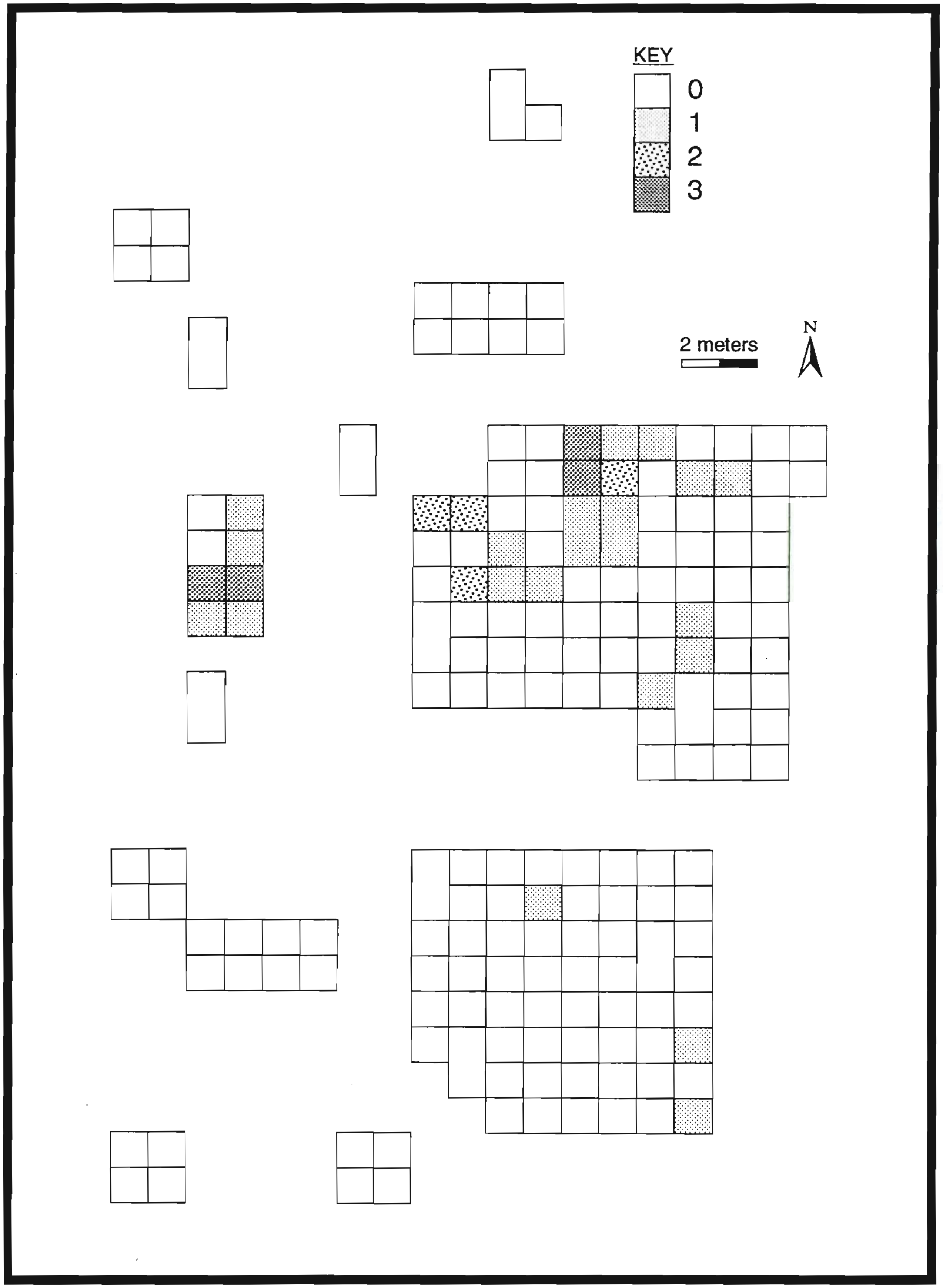


FIGURE 23: Distribution of Chalcedony in Subsoil (Early and Middle AU) Contexts

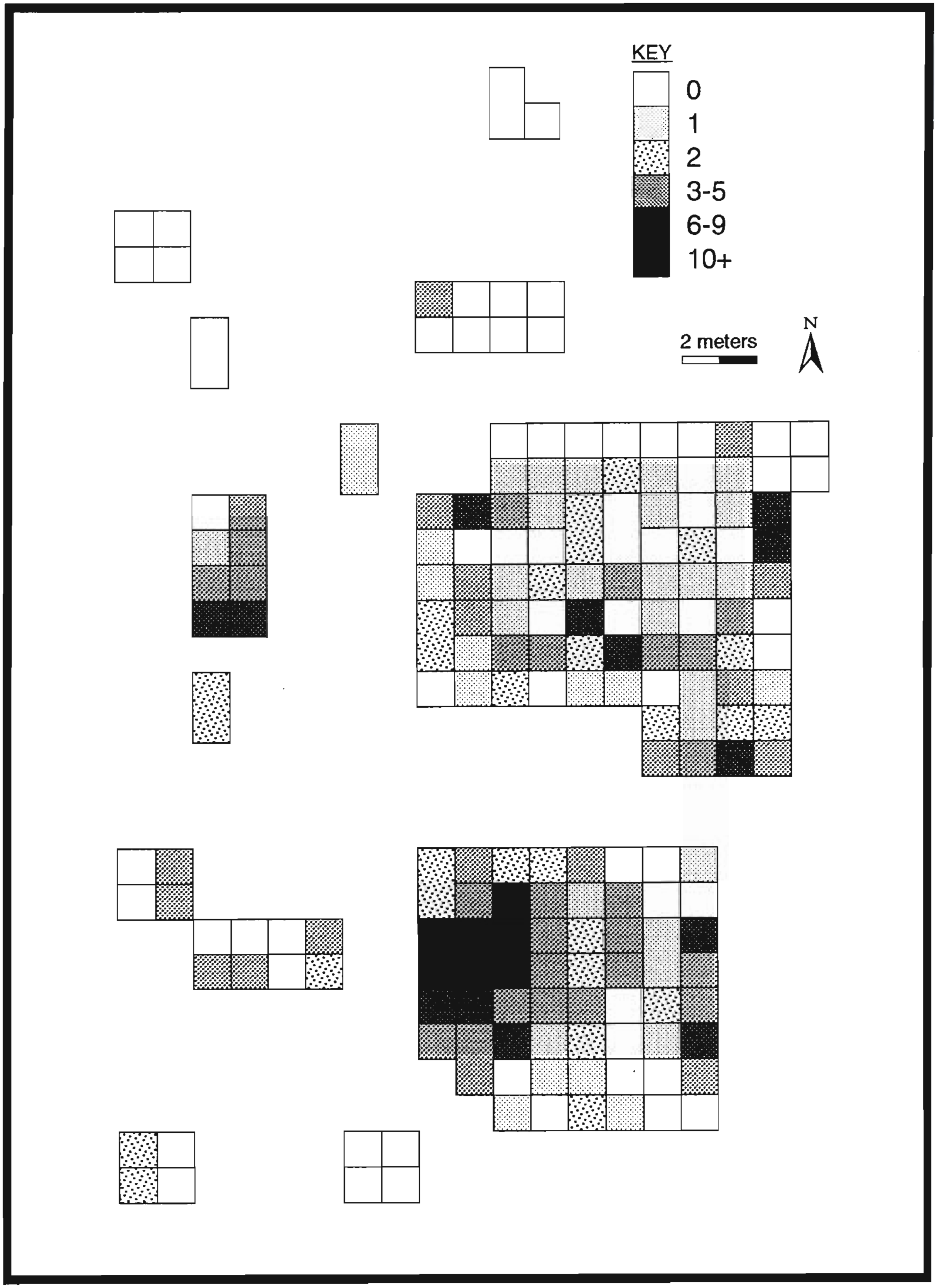


FIGURE 24: Distribution of Chert in Early AU Contexts

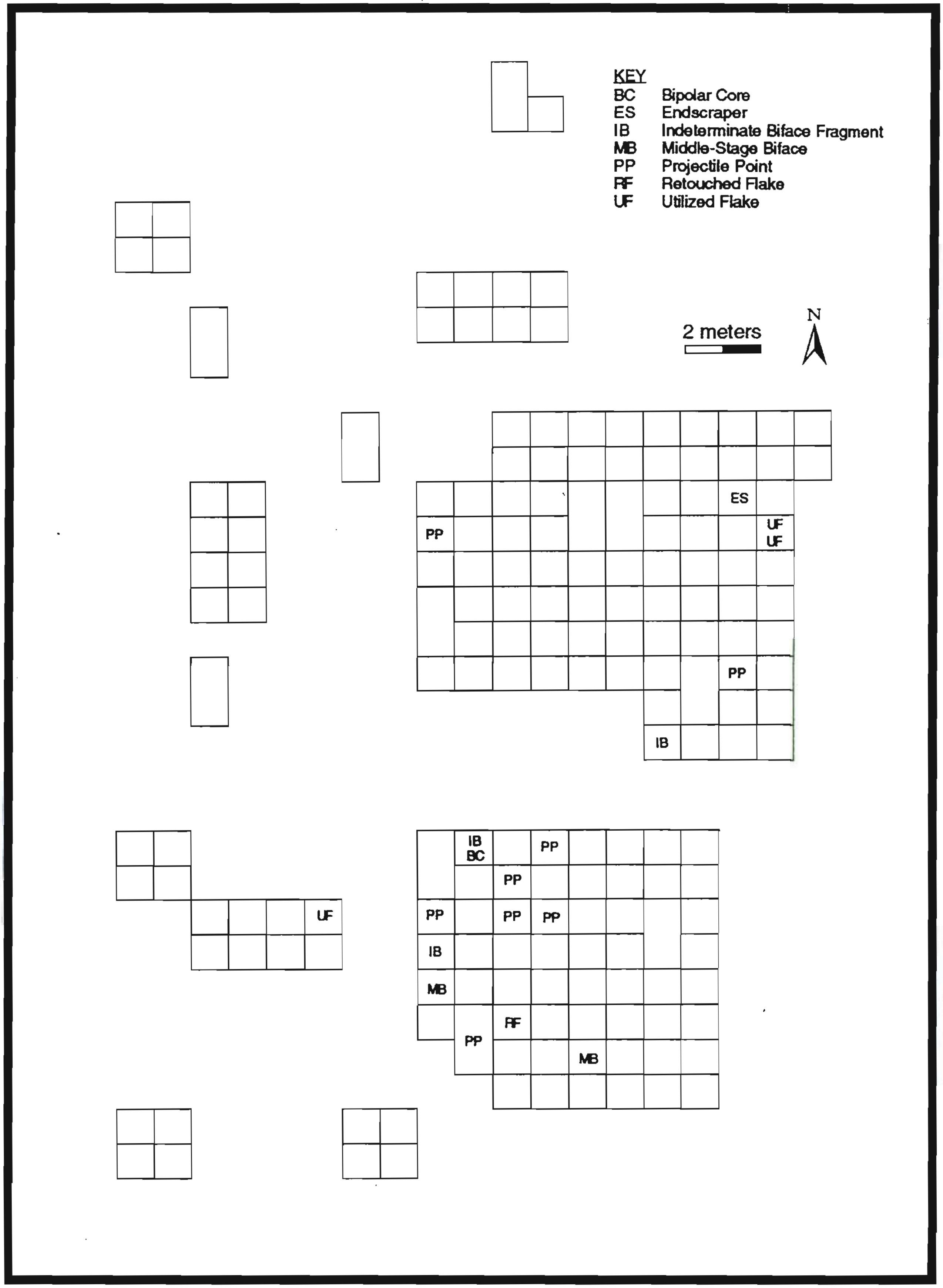


FIGURE 25: Distribution of Chert Tools in Early AU Contexts

(Figure 26). In the Early AU contexts, there are three concentrations of jasper. The largest of these occurred in Units 42, 45, 51, and 54, overlapping the concentrations of vein quartz, quartzite, and chert. The second largest concentration was in Unit 23 of the North Excavation Block, an area which had been severely disturbed by downcutting and historical interments. The smallest discernible concentration of jasper occurred adjacent to Feature 33, a small lithic workshop area located along the eastern margin of the South Excavation Block (Unit 41), which was represented by a large, early-stage argillite biface and four argillite flakes. Jasper tools in the Early AU include 10 projectile points, 1 early-stage biface, 1 middle-stage biface, 1 late-stage biface, 4 indeterminate bifaces, 2 endscrapers, 2 sidescrapers, 3 retouched flakes, 2 utilized flakes, and various cores (6 bipolar, 1 freehand, and 1 tested cobble). The spatial distribution of jasper tools in the Early AU contexts shows a rather broad distribution, with the majority of the tools in the South Excavation Block (Figure 27). However, the majority of the jasper unifacial tools are in outlying contexts, a pattern similar to that of the chert tools. Many of the jasper points in the South Block apparently are related to the concentration focused on Feature 31.

Most of the raw material concentrations associated with the Early AU contexts are located in the South Excavation Block, where they appear to be associated with Feature 31, the cooking/heating area, and with Feature 22, the milling area that includes the mano and metate. Other cobble tools associated with this area include two quartzite cobbles with mano wear (Unit 39), a quartzite pestle (Unit 45), a quartzite hammerstone (Unit 42), and a quartz hammerstone (Unit 45), as illustrated in Figure 28. The widespread distribution of unifacial tools in the Early AU contexts, noted above for chert and jasper, is illustrated in Figure 29.

Contexts assigned to the Middle AU are presumably most representative of the site's Late Archaic/Early Woodland occupations. The culturally diagnostic artifacts associated with the Late Archaic/Early Woodland occupation consist of a heterogeneous group of 12 stemmed points, in which no more than two are comparable in size and haft morphology. Among these points, there are examples that may be assigned to the Morrow Mountain, Teardrop, Rossville, and Koens Crispin types. Based on raw material, the 12 points in this group form two readily discernible subgroups; 7 are made from argillite, and 5 are made from jasper and chert. Ten of the 12 points in this group are concentrated in an east-west band across the North Excavation Block, encompassing Units 9, 10, 11, 19, 20, 22, and 24 (Figure 30). The two outliers in the group include an argillite example from Unit 38, which may be associated with the argillite workshop area (Feature 33) in the adjacent Unit 46, and a jasper example from Unit 49. The latter point may in fact be a Middle Archaic Morrow Mountain stemmed point, and it was recovered from a context assigned to the Early AU.

Argillite is the lithic raw material most clearly associated with the Late Archaic/Early Woodland occupation. Because argillite accounts for a very small fraction of the lithic assemblage, it is somewhat misleading to identify concentrations of this material. Argillite was used exclusively for the stemmed points assigned to the Late Archaic/Early Woodland group, and it is arguable that all of the argillite in the site assemblage is assignable to the Middle AU, regardless of its specific provenience within the site. Overall, argillite occurs stratigraphically somewhat higher, as measured by raw material frequencies in the excavation levels, than materials such as quartz and quartzite which are most strongly associated with the Early Archaic components (see Figure 9). Most of the argillite was recovered from subsoil contexts in the North Excavation Block (Figure 31), a pattern that is similar to that of the diagnostic stemmed points. The highest frequencies of argillite were from Units 15 and 18, an area which was extensively disturbed by historical burials. Other contexts with high frequencies of argillite occur in Units 41 and 42, located in the South Excavation Block. The high frequency of argillite in Unit 41 includes Feature 33, an early stage biface and a few pieces of debitage, and an associated stemmed point.

Jasper was the second most common raw material used for the Late Archaic/Early Woodland stemmed points, accounting for 4 of the 12 points in this group. One of these points, however, may be a Middle Archaic, Morrow Mountain point, and this example was recovered from a context assigned to the Early AU. A large concentration of jasper in the Middle AU contexts cuts across the North Excavation Block, including portions of Units 10, 14, 15, 18, 21, 22, and 26 (Figure 32). Jasper tools in the Middle AU include 18 projectile points, 1 middle-stage biface, 1 late-stage biface, 6 indeterminate bifaces, 3 endscrapers, 7 retouched flakes, 6 utilized flakes, and 5 bipolar cores. The spatial distribution of jasper tools in the Middle AU contexts shows a somewhat diffuse concentration across most of the North Excavation Block, with the highest frequencies of tools somewhat to the west of the highest debitage concentrations (Figure 33).

Chert, like jasper, is one of the most common lithic materials in the site assemblage, and it is widely distributed across the site. One of the 12 stemmed points assigned to the Late Archaic/Early Woodland

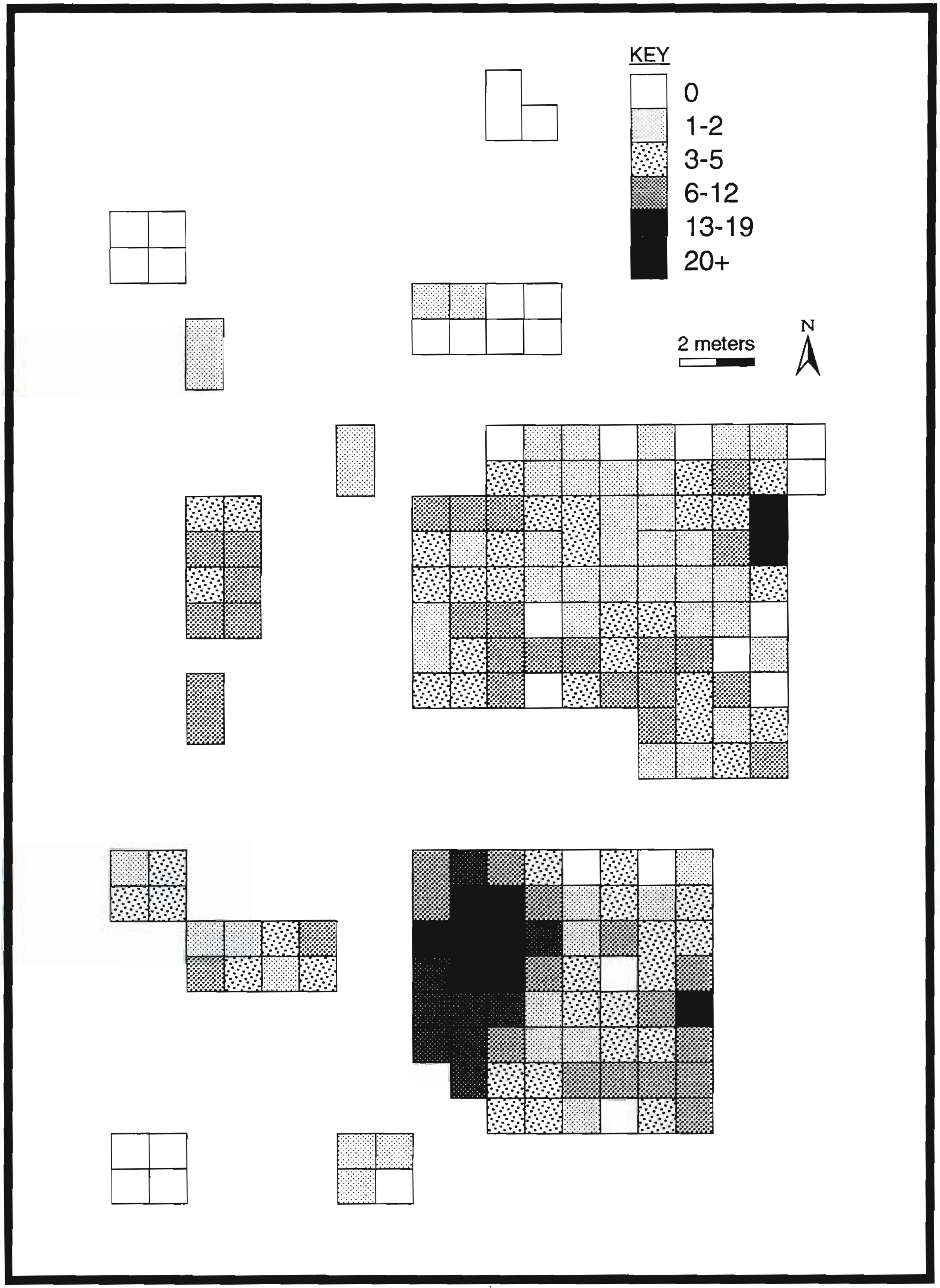


FIGURE 26: Distribution of Jasper in Early AU Contexts

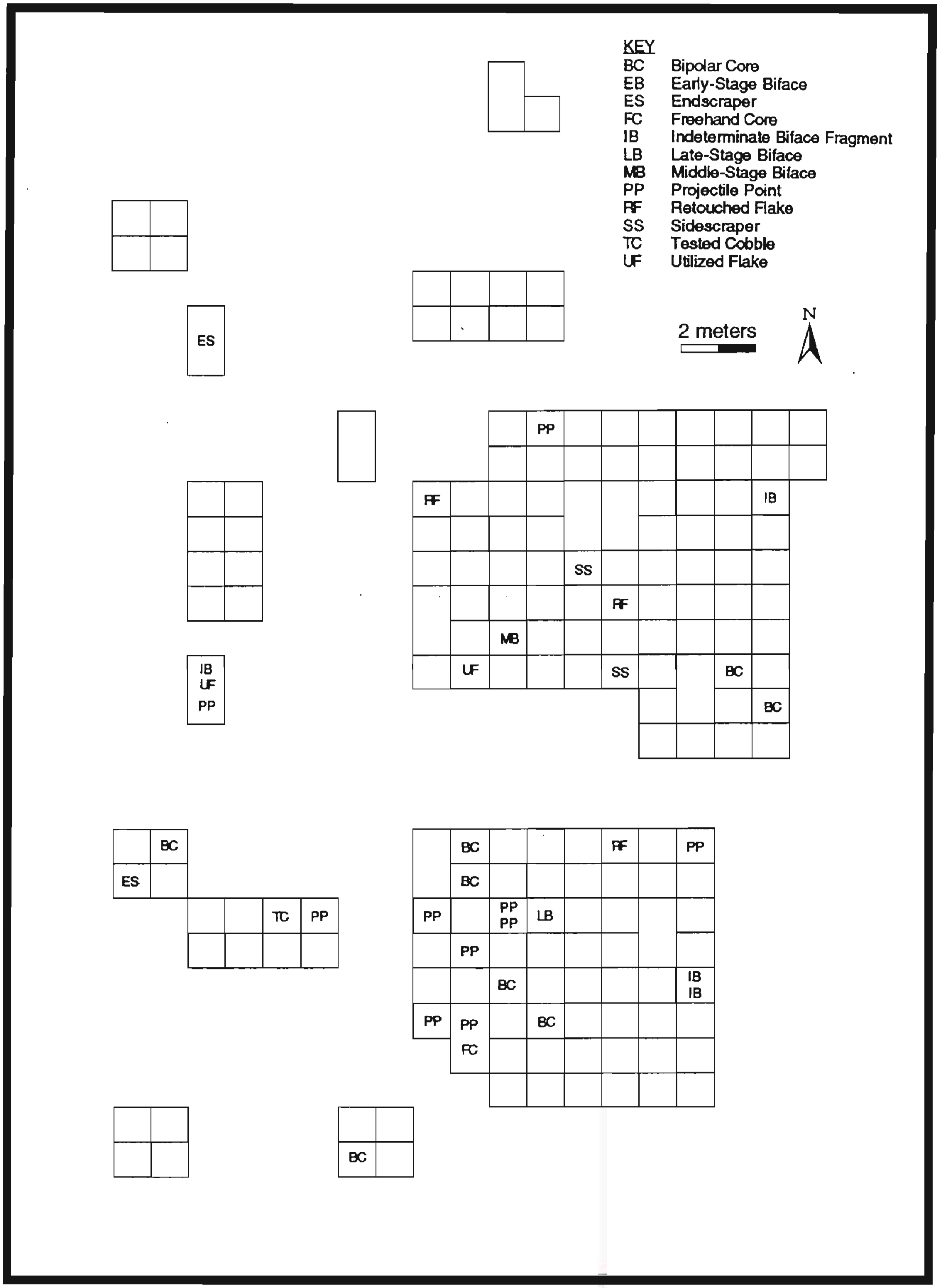


FIGURE 27: Distribution of Jasper Tools in Early AU Contexts

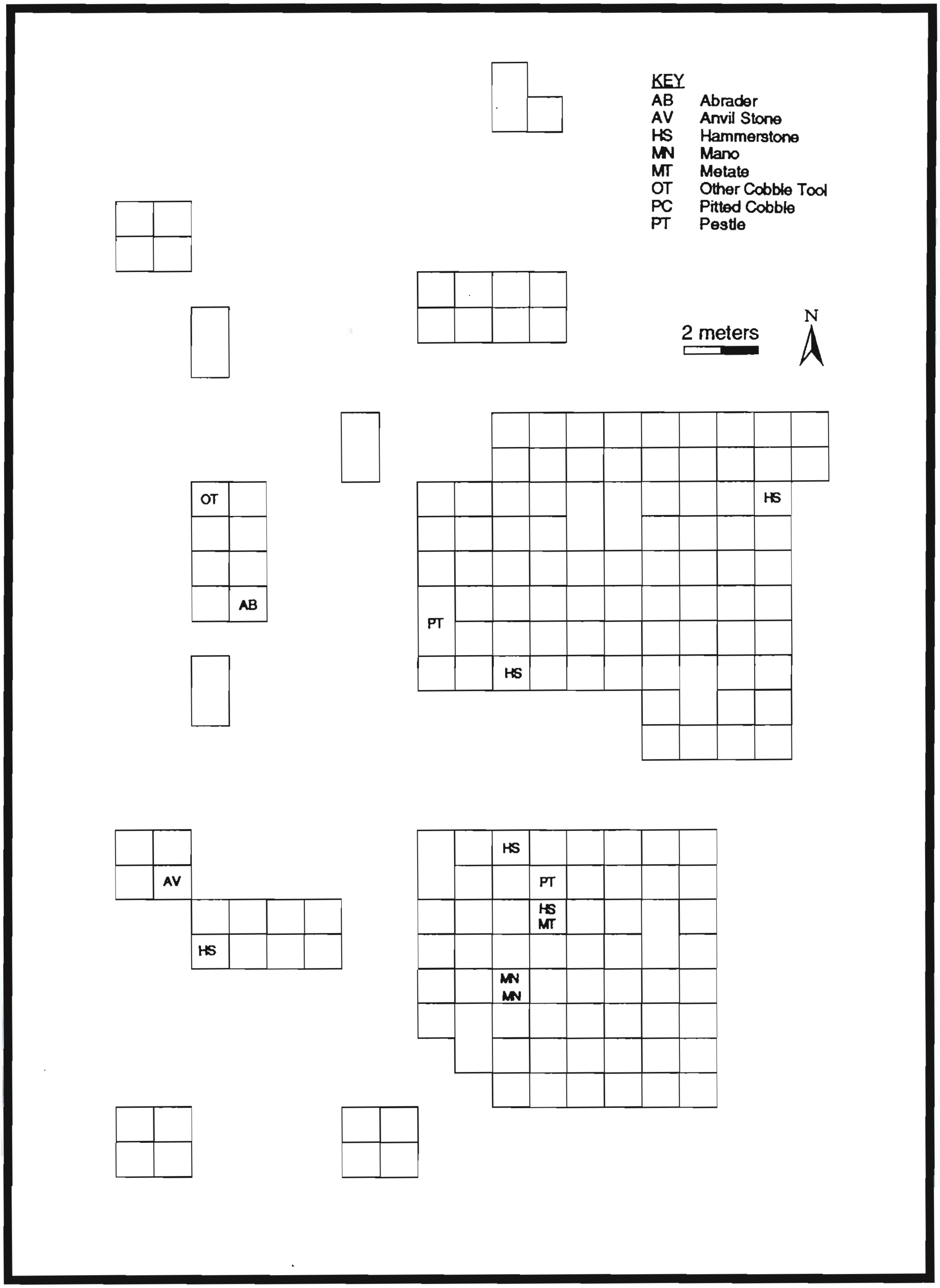


FIGURE 28: Distribution of Cobble Tools in Early AU Contexts

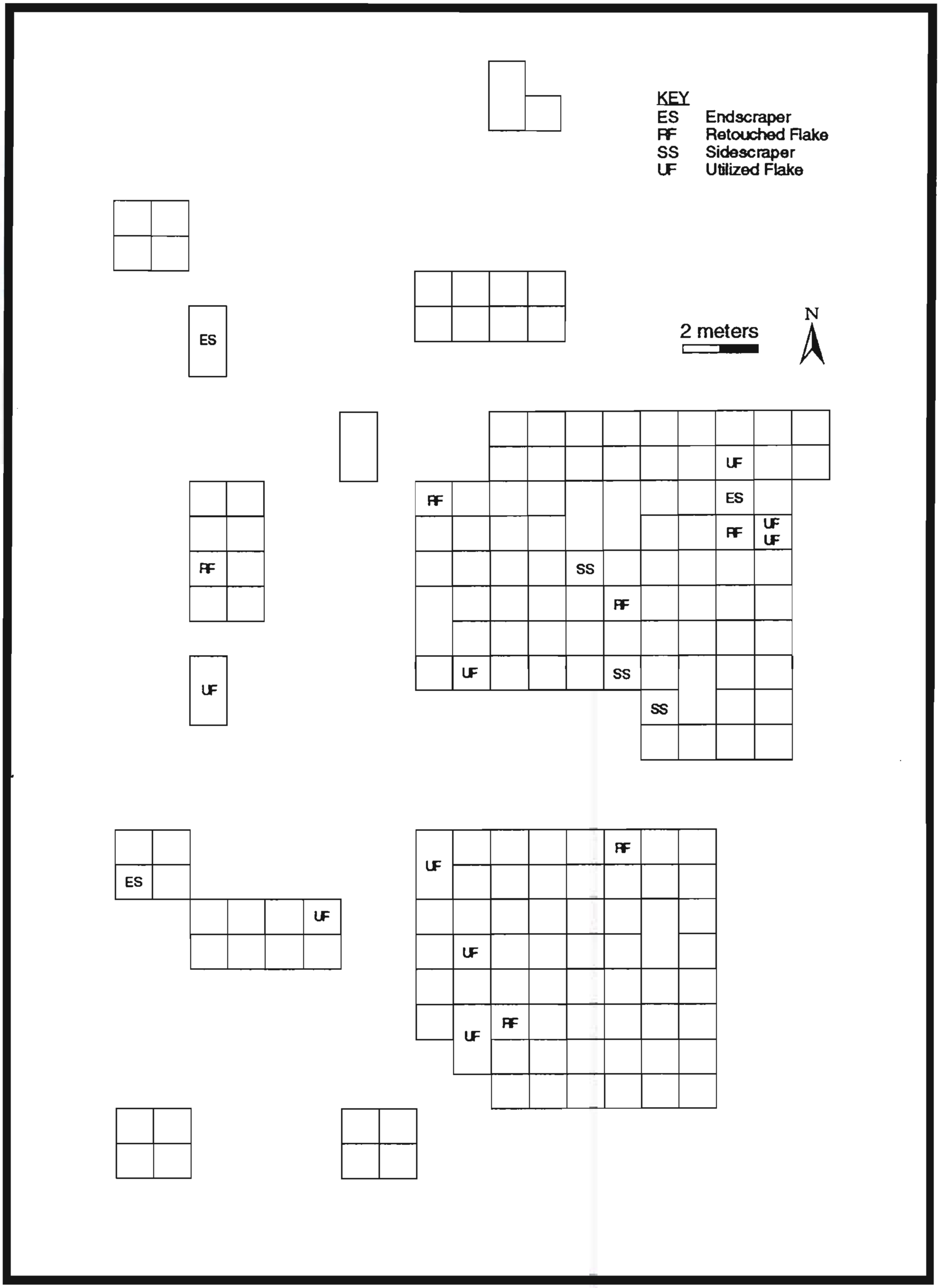


FIGURE 29: Distribution of Unifacial Tools in Early AU Contexts

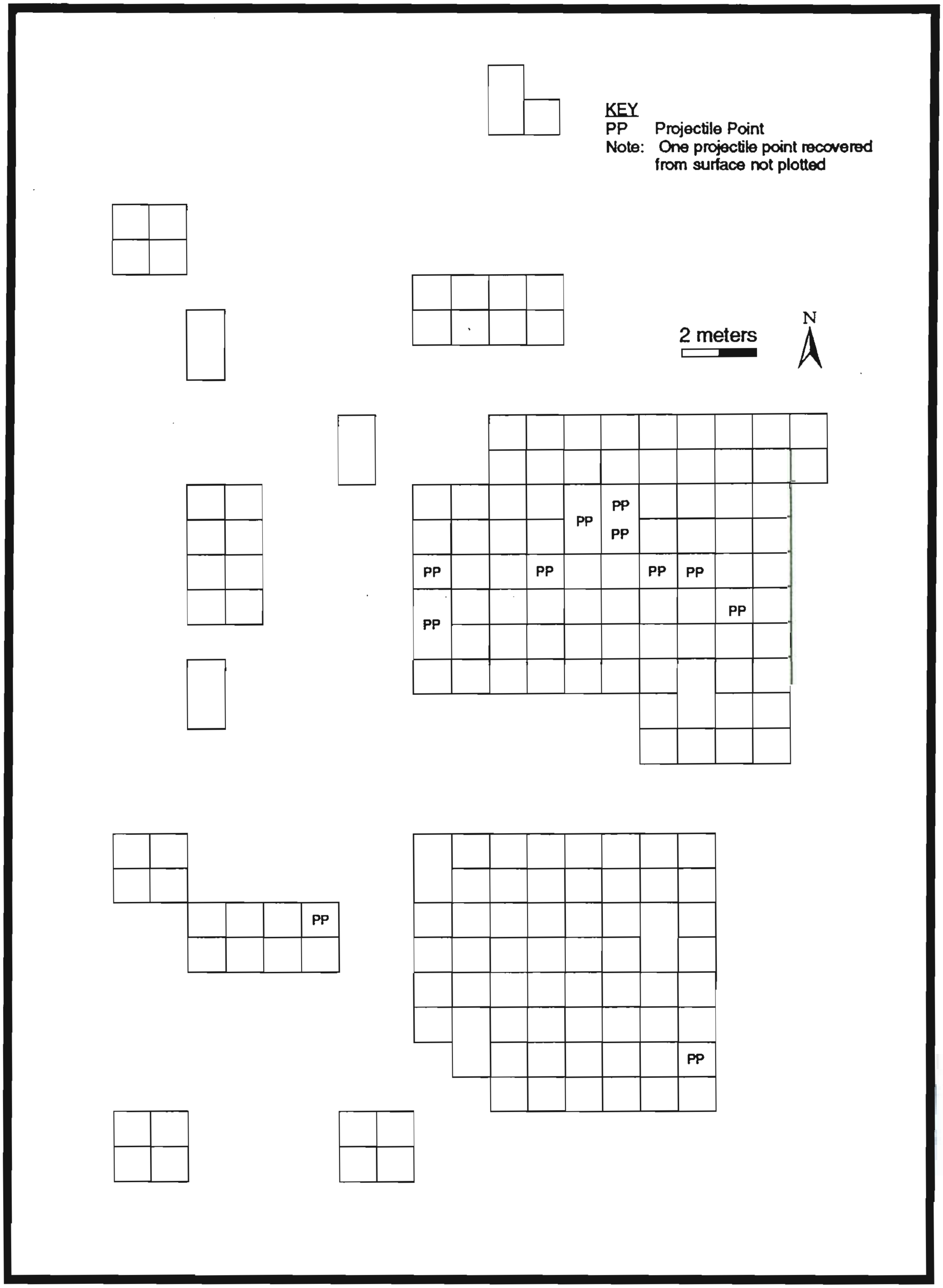


FIGURE 30: Distribution of Late Archaic/Early Woodland Points

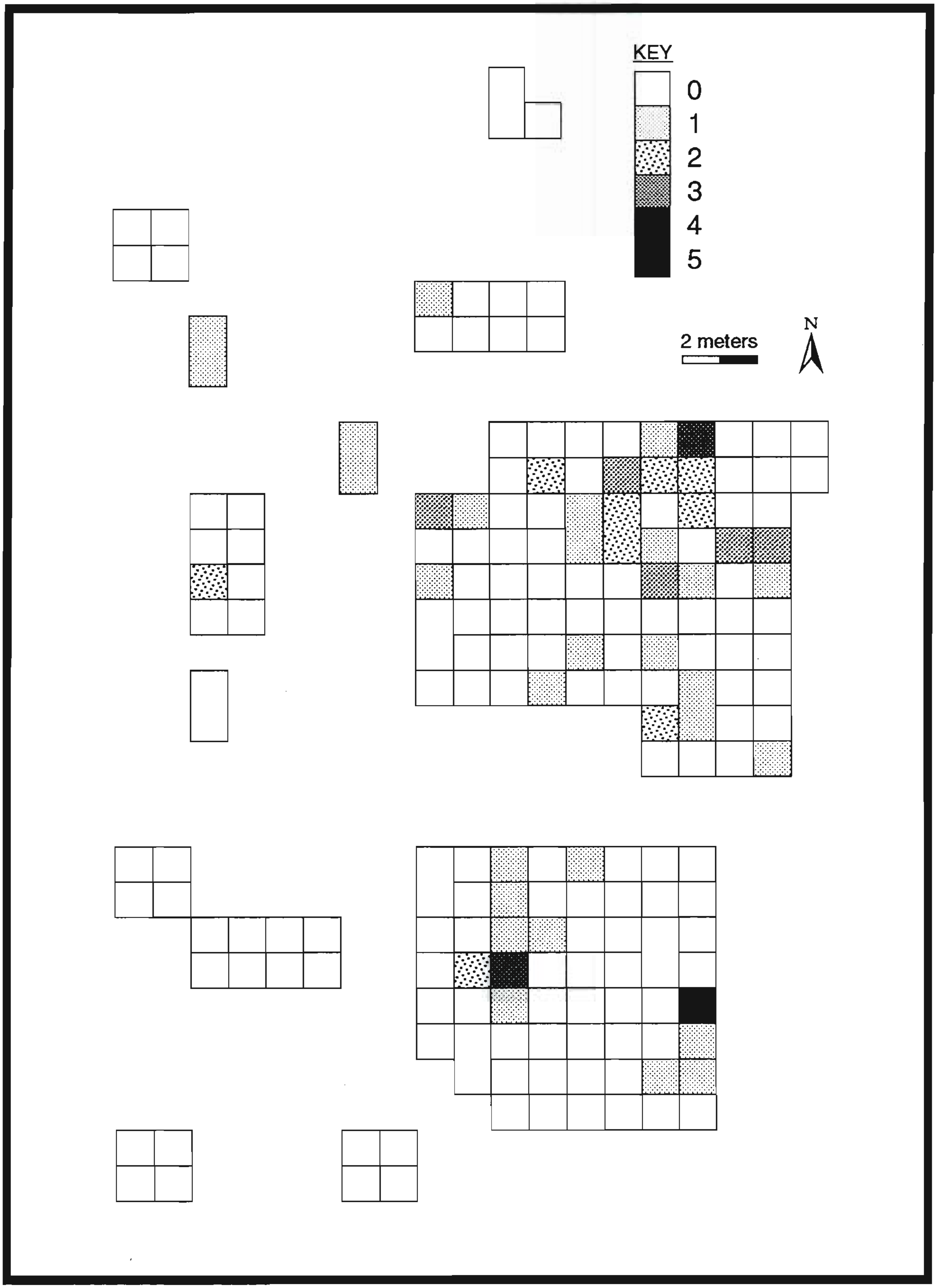


FIGURE 31: Distribution of Argillite in Subsoil (Early and Middle AU) Contexts

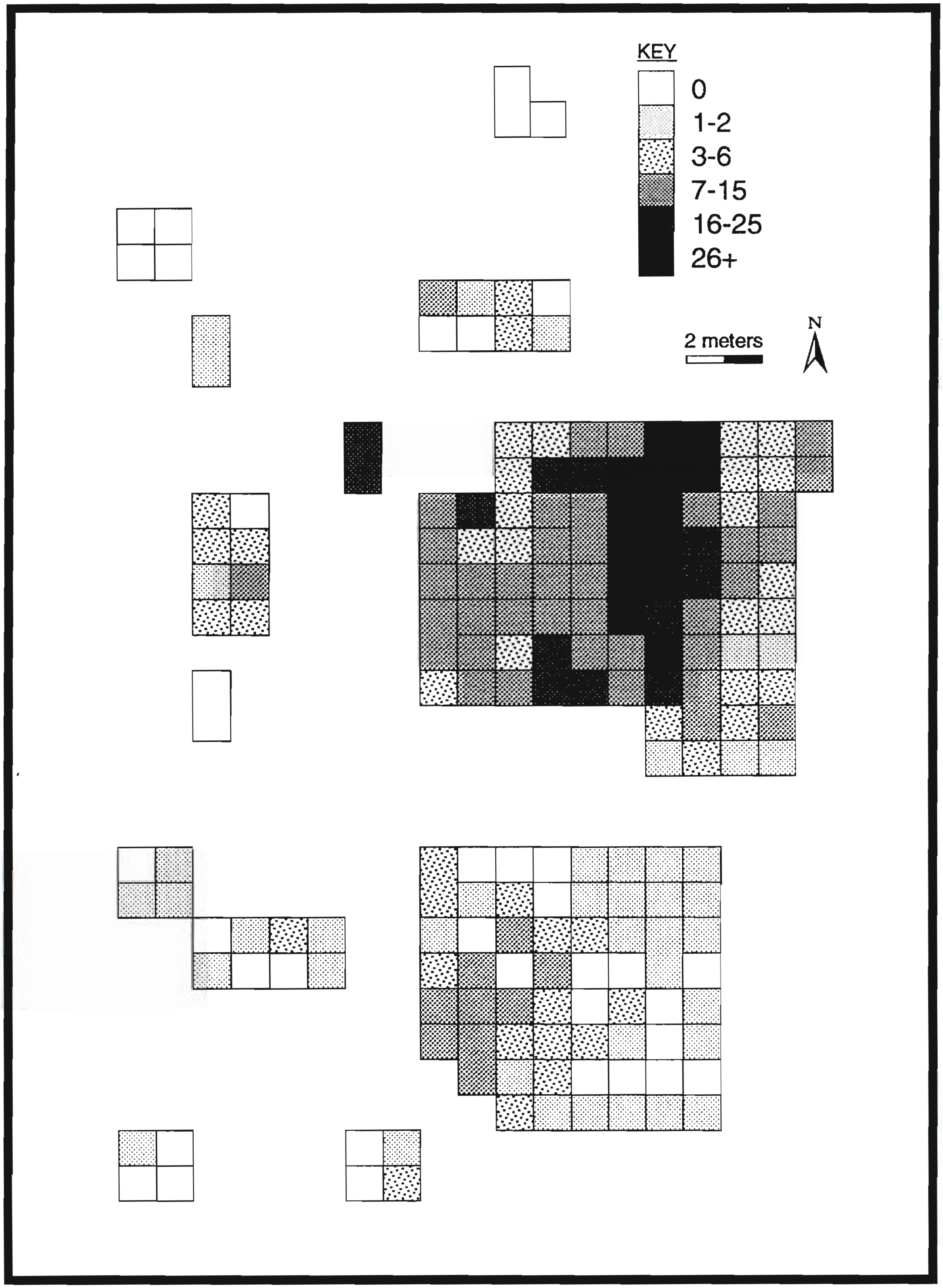


FIGURE 32: Distribution of Jasper in Middle AU Contexts

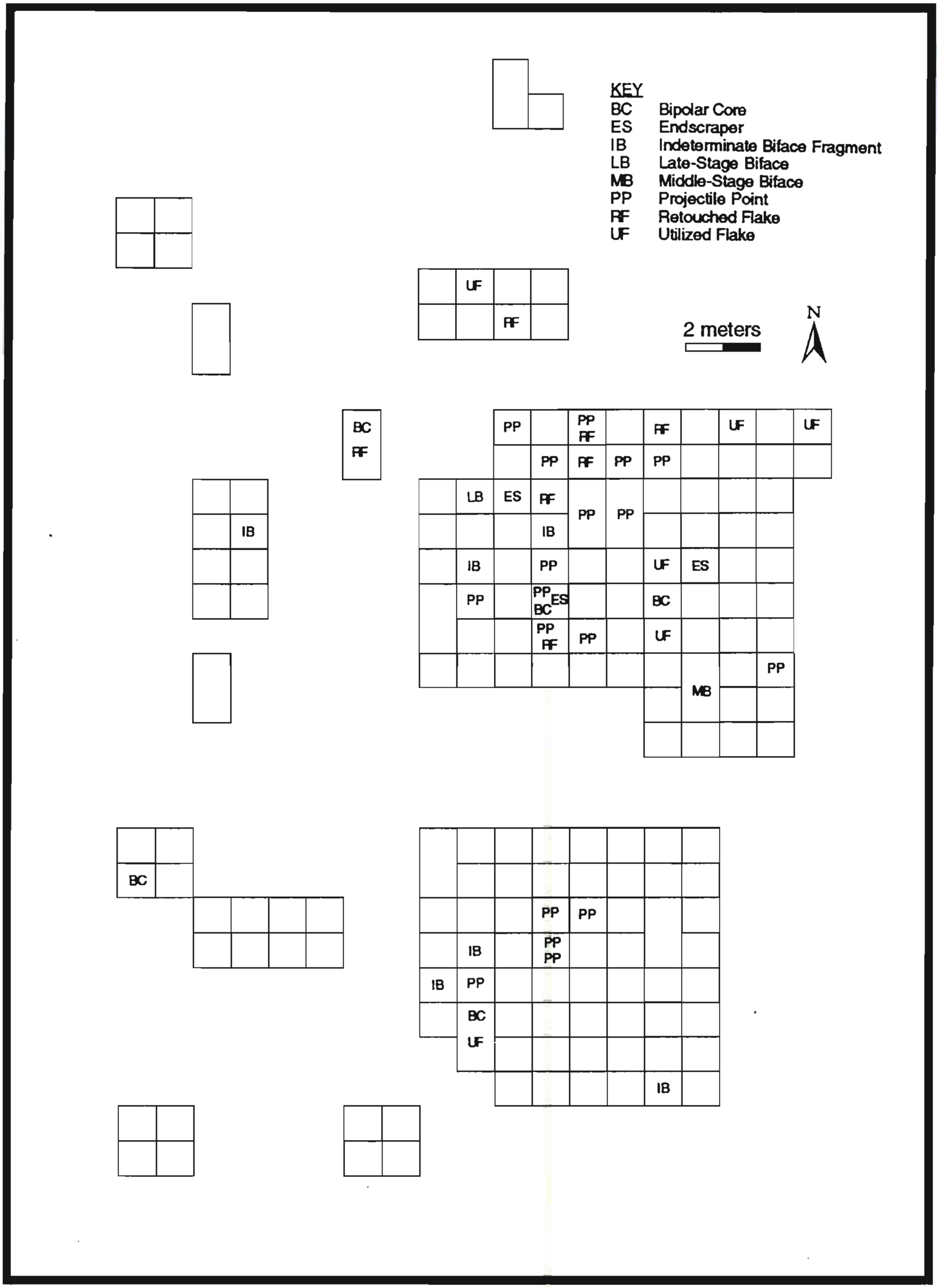


FIGURE 33: Distribution of Jasper Tools in Middle AU Contexts

group was made of chert, although chert was also a preferred material during the Early Archaic. The distribution of chert in Middle AU contexts is comparable to that of jasper, as there is a large concentration in the North Block, extending over several units (Figure 34). Like jasper, the chert concentration overlaps the distribution of Late Archaic/Early Woodland stemmed points, and it encompasses portions of Units 9, 13, 14, 15, 18, 21, and 22. Chert tools in the Middle AU include 8 projectile points, 2 middle-stage bifaces, 3 indeterminate bifaces, 1 endscraper, 1 retouched flake, 3 utilized flakes, and 1 bipolar core. The spatial distribution of chert tools in the Middle AU contexts shows a somewhat diffuse concentration across the site, with most tools in the North Excavation Block, similar to the pattern observed for jasper tools (Figure 35).

Contexts assigned to the Late AU are presumably most representative of the Late Woodland occupation of the site. Diagnostic artifacts associated with the Late Woodland include a single jasper triangular point and the sample of shell-tempered ceramics. The site's ceramic assemblage is quite small, and it is possible that the entire assemblage represents only one or two vessels. The majority of the assemblage is made up of shell-tempered sherds that may be assigned to the Townsend/ Rappahannock ware types of the Late Woodland period, although a few sherds with sand and grit temper may represent Early or Middle Woodland wares. The Late AU coincides with the plowzone contexts, and because these contexts are largely disturbed, analysis of spatial patterning is limited.

The single Late Woodland jasper point was in fact recovered from a context assigned to the Middle AU in the South Excavation Block (Level 2 of Unit 42), which attests to the mixing of deposits. As there is only one diagnostic lithic artifact assignable to the Late Woodland occupation, interpretations of lithic preference must be made with caution. Jasper was a preferred raw material throughout the site's major occupation periods, but the relatively elevated position of this raw material in the site profile (see Figure 9) attests to the preference of this material during the more recent occupations. While jasper was broadly distributed throughout the site's Late AU contexts, three concentrations were identified in Units 15, 21, and 23, all of which are in the North Excavation Block (Figure 36). Two of these units (15 and 23) were extensively disturbed by historical interments. The concentration of jasper in the Late AU contexts is similar to that observed in the Middle AU contexts (see Figure 32). Jasper tools in the Late AU contexts include 8 projectile points, 3 indeterminate bifaces, 1 endscraper, 8 retouched flakes, 2 utilized flakes, 5 bipolar cores, and 1 tested cobble. The broad distribution of these tools across the site (Figure 37) is similar to the distribution of jasper tools in the Middle AU contexts. For ceramics, the vertical distribution is much higher vertical than for any of the lithic materials (see Figure 9). Based on both sherd frequency and total weight, the highest ceramic concentration in the Late AU contexts was in Unit 5, in the North Excavation Block. The general distribution of material associated with the Late AU contexts shows that the deposits are most concentrated in the North Excavation Block. This pattern is similar to that of the Middle AU contexts, which suggests either that the same areas of the site were used during the Late Archaic/Early Woodland and Late Woodland occupations, or that the deposits associated with these occupations have been mixed. Discernment of spatial patterns in the Late AU contexts is hindered by post-depositional disturbances, particularly historic cultivation, roadway construction, and historic interments in the North Excavation Block.

In summary, analysis of the site's internal distribution patterning of various materials has permitted recognition of a number of concentrations that may represent activity areas. The presence of activity areas in association with features is notable in itself, given the loose, sandy soils that are easily displaced by natural turbation processes. While spatial patterning is apparent, it is also evident that there has been a great deal of overlap in the areas of the site used during individual occupational episodes, and there was no clear stratigraphic separation between the deposits associated with different periods or phases of occupation. The internal site patterning is evident from various perspectives. First, there were many examples of individual point types, tools, and debitage concentrations in specific areas of the site, indicating that certain areas were the focal points for various activities within the primary habitation area. Also, the clustering of diagnostic point types indicates that individual occupational phases or episodes occurred within fairly restricted areas of the site.

There is evidence of a Paleoindian occupation of the site, represented by crystal quartz tools and debitage. Crystal quartz was concentrated in Units 35 and 48, located on the western margin of the site. Feature 21, an activity area indicated by a cobble chopper and hoe, was in this area of the site; however, it is likely that Feature 21 is associated with the Early Archaic component, as concentrations of vein quartz, chalcedony, and chert were also present in this area.

Early Archaic occupation of the site is represented by various Palmer, Kirk Corner Notched, Kirk Stemmed, Decatur, and bifurcate-based points, which were made from a variety of raw materials. Concentrations of vein quartz, quartzite, chert, and jasper associated with the Early AU contexts were all located in the South

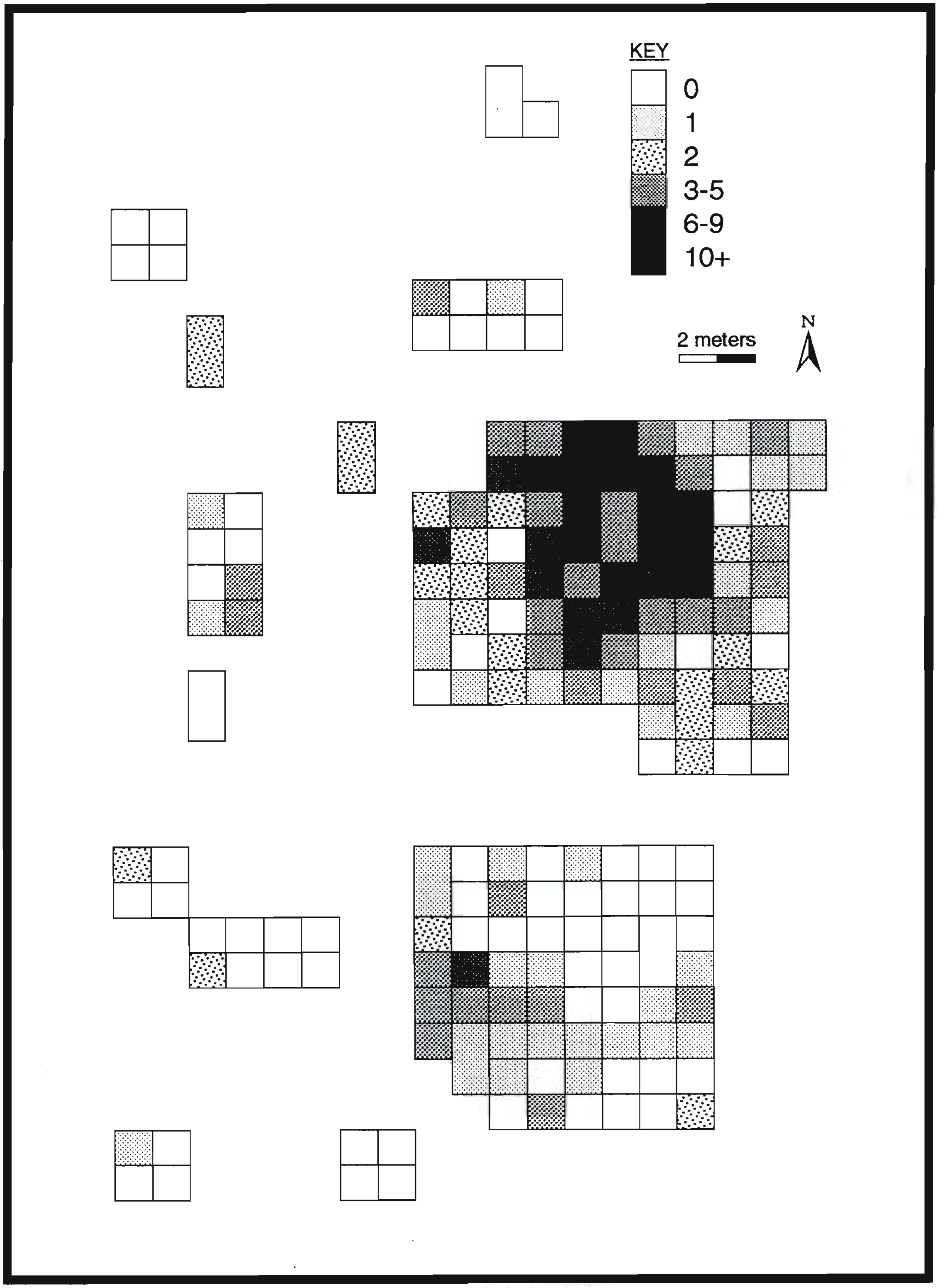


FIGURE 34: Distribution of Chert in Middle AU Contexts

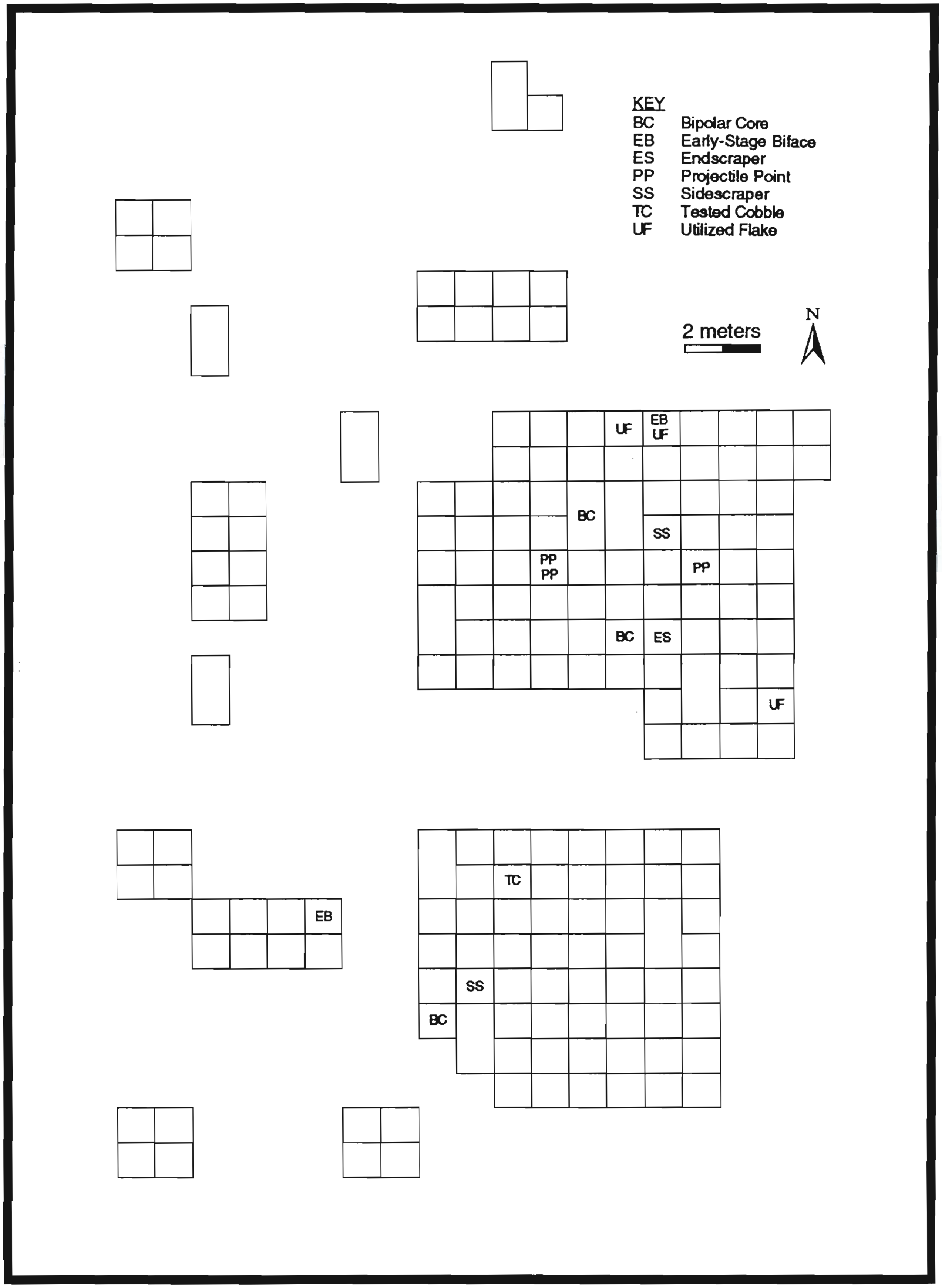


FIGURE 35: Distribution of Chert Tools in Middle AU Contexts

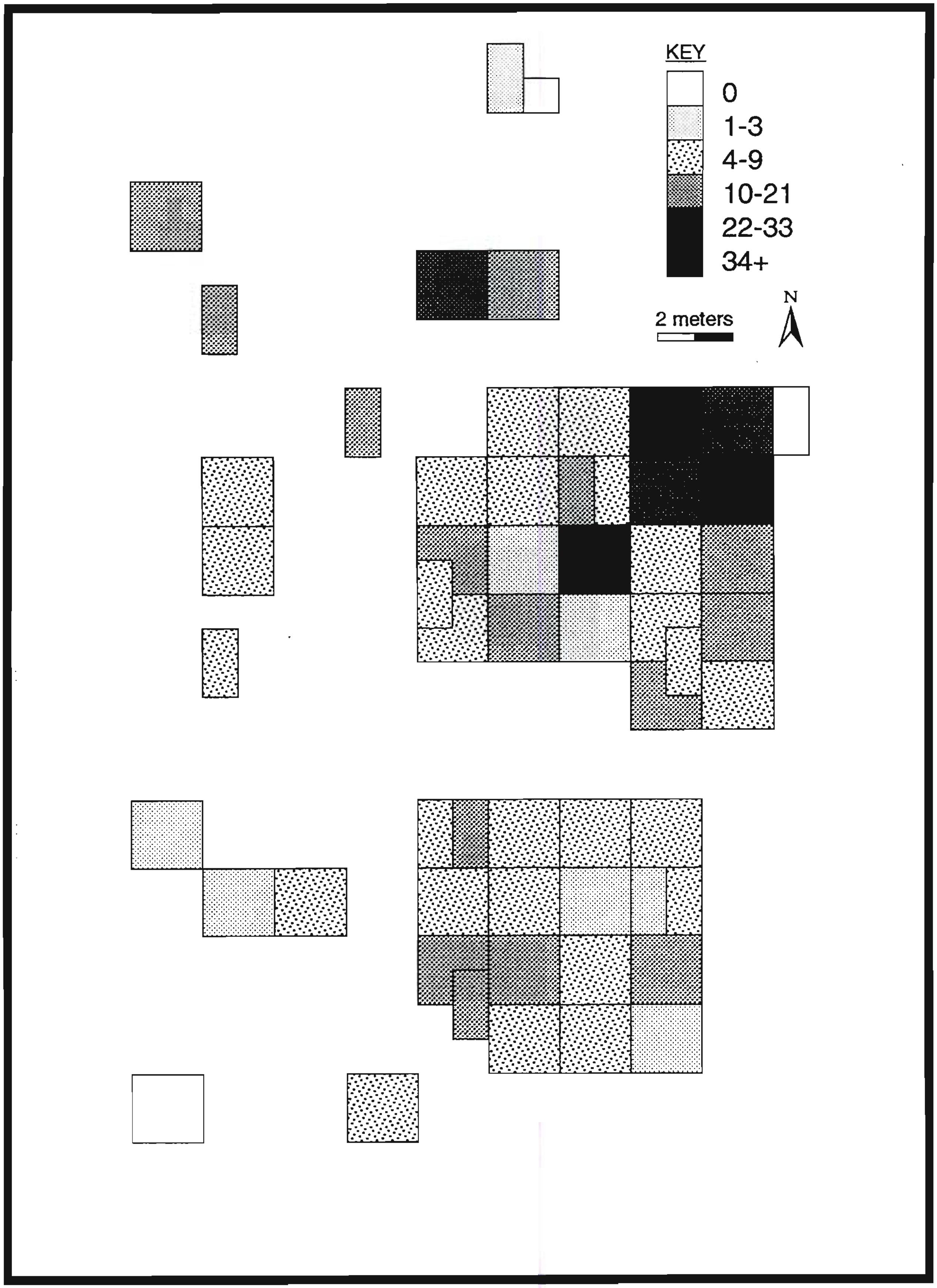


FIGURE 36: Distribution of Jasper in Late AU Contexts

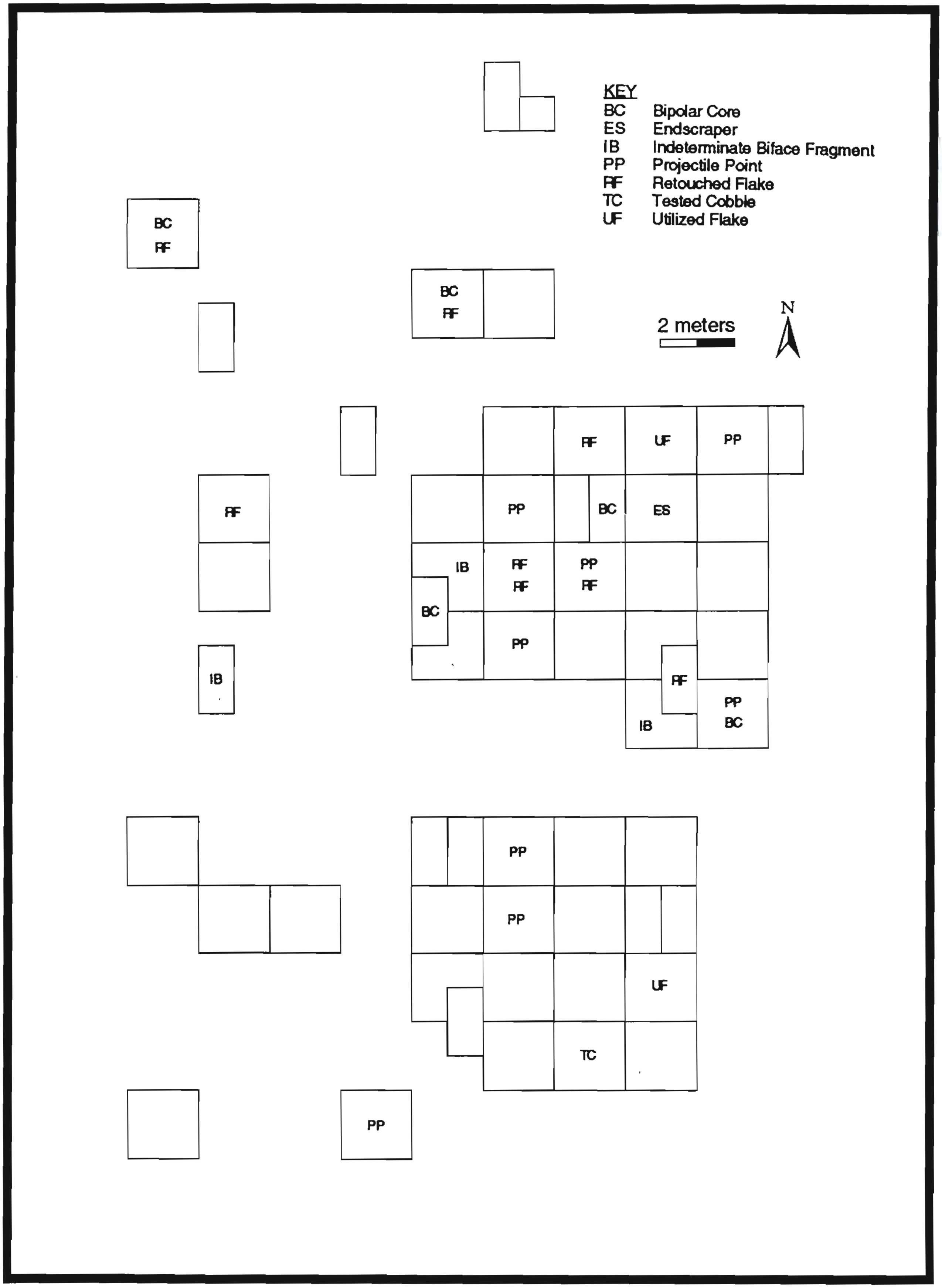


FIGURE 37: Distribution of Jasper Tools in Late AU Contexts

Excavation Block, apparently associated with a formal cooking/heating area represented by a concentration of FCR (Feature 31) and a milling area consisting of a mano and metate (Feature 22). The largest concentration of Early Archaic points was located in this area, and within the same unit (Unit 45) that yielded the oldest radiocarbon sample from the site. This date (7560 $\pm$ 340 years BP; sample # Beta-56049) is consistent with an Early Archaic use of this part of the site. The overlapping of vein quartz, quartzite, chert, and jasper in this area of the site suggests a relatively consistent use of this part of the site during the repeated episodes of site occupation during the Early Archaic. While the spatial distribution shows a consistent pattern of projectile points, debitage, and cobble tools in the South Block, it is also interesting that the unifacial tools associated with the Early AU contexts are more widely distributed over the site area. It was noted that a vein quartz sidescraper, and various chert and jasper unifacial tools were consistently recovered from Early AU contexts in the North Excavation Block, suggesting that this was a secondary activity area used for tasks such as hide processing during the Early Archaic.

The distribution of Late Archaic/Early Woodland points also exhibited a distinct spatial pattern, with most points located in the North Excavation Block. Although a majority of the points assigned to that group were made of argillite, the overall scarcity of argillite in the assemblage precluded identification of an associated lithic reduction area. Other raw materials associated with the Late Archaic/Early Woodland occupation, notably jasper and chert, did exhibit concentrations in the North Excavation Block, overlapping the distribution of diagnostic stemmed points. Identification of spatial patterning associated with the Late Woodland component was limited by the fact that the contexts associated with that component had been subjected to various post-depositional disturbances such as historic cultivation and historic interments.

F. RESIDUE ANALYSIS

While charred plant remains were recovered from prehistoric contexts, faunal remains were nonexistent, owing greatly to local soil conditions. Consequently, residue analysis was undertaken in the hope that subsistence information could be gleaned from the surfaces of stone tools. Two levels of residue analysis were conducted, in addition to a limited test for pollen. The pollen test involved the examination of two cobble tools found in close association (Feature 22) that may represent a plant processing unit (mano and metate). The pollen analysis, however, proved to be inconclusive (Kelso 1992). Residue analysis tested for traces of blood and proteins. The Level I analysis is a simple presence-absence test for blood, and the Level II analysis is a sophisticated family-level, or in some cases a species-specific, test that detects not only traces of blood proteins but also of proteins from body tissues and fluids. Both methods focus on residues from animals, but the Level II analysis also tests for fern residue.

Before proceeding to a summary of the results of the analyses, it should be noted that residue analysis is a relatively new analytical tool employed by archaeologists, and its analytical value is not yet fully understood. While interesting and encouraging test results have been achieved, particularly with family- and species-level tests, attempts at independent verification of test results have been limited. In addition, a number of questions, particularly about the effects of various site formation processes, have yet to be resolved to the satisfaction of many researchers.

As part of both the Level I and the Level II analyses, sediments from the site were submitted for testing. These "control samples" all tested negative. Specimens were selected for residue analysis in the laboratory and were not washed or labeled, but they were inventoried and photocopied with a minimum of handling. Currently, none of the artifacts that were submitted for analysis have been washed, although dry brushing has been done. Specimens that tested negative in the Level I analysis and were not subjected to Level II analysis were labeled. Artifacts that tested positive at either level have not been labeled.

1. *Level I: Presence/Absence Testing*

Level I testing was performed by the Archaeology Laboratory at the University of Delaware, under the direction of Dr. Jay Custer. The method used is simple; in brief, it entails creating a solution with distilled water and soil adhering to the surface of an artifact. This solution is tested for blood residue by using a commercially available chemstrip, which registers the presence of blood residue by changing colors (see Custer et al. 1988a, 1988b).

In total, 186 lithic artifacts, representing six different artifact classes, were tested (Table 21). Only seven specimens tested positive: one biface and six pieces of debitage. These seven, along with 43 other specimens, were submitted for family-level testing. Eleven of the 43 had been tested and produced a negative result for the presence of blood residue but were included in the Level II sample as a means of cross-checking the efficacy of the two techniques (see also LeeDecker et al. 1991:107).

TABLE 21: SUMMARY OF LEVEL I BLOOD RESIDUE ANALSIS RESULTS

ARTIFACT CLASS	TOTAL ARTIFACTS	PRESENT	ABSENT
Bifaces	41	1	40
Unifaces	25	0	25
Cores	19	0	19
Debitage	77	6	71
Cobble Tools	10	0	10
Cracked Rock	14	0	14
TOTAL	186	7	179

2. *Level II: Family-Level Testing*

Family-level animal and plant (fern) residue tests were performed under the direction of Dr. Margaret Newman at the Laboratory for Archaeological Science, California State University, Bakersfield (Newman 1993).

Fifty artifacts were tested: 33 bifaces, 7 unifaces, 2 cores, 2 cobble tools, and 6 pieces of debitage. Eleven produced positive results (9 bifaces, 1 uniface, and 1 debitage), and 5 produced a nonspecific reaction (NSR) (Table 22). Of the 17 "families" for which the 11 artifacts were tested, 7 were found to be present: one biface tested positive for deer and rabbit; three bifaces tested positive for deer; one biface tested positive for rabbit; two bifaces tested positive for dog; one biface tested positive for Guinea pig; one biface tested positive for bovine; one uniface tested positive for bear; and one early-reduction flake tested positive for chicken.

It must be stressed that these "families" are based on immunological associations and do not necessarily have a direct relationship to the Linnaean classification scheme. The family names refer to the antisera that are prepared for use in the analysis (Newman 1993). However, it can be inferred that a positive reaction to the deer antiserum marks the presence of white-tailed deer, and likewise, that rabbit antiserum is indicative of cottontail rabbit or related species; dog antiserum can indicate any member of the Canidae family (e.g., wolf, fox, or domestic dog); guinea-pig antiserum could include beaver, squirrel, or porcupine; bovine antiserum indicates American bison or domestic species; bear antiserum implies the presence of black bear; and chicken antiserum could indicate any number of upland game birds (e.g., wild turkey, quail, or grouse).

3. *Discussion*

Before discussing the subsistence implications of the test results, it must be mentioned that an important methodological issue is brought to light when one compares the results of the Level I and Level II analyses. The fact is, the correlation between the results is very low: of the seven artifacts that tested positive for the presence of blood residue during the Level I testing, only one of them tested positive during the Level II testing. In other words, one biface and six pieces of debitage tested positive for the presence of blood, but during the family-level testing only one piece of debitage tested positive. Dr. Newman suggests two likely explanations: either the Level I testing removed all traces of blood, or the Level I positive results were caused by contaminants (see also Manning 1994).

Equally interesting is the biface (Cat. #926) that tested negative for blood residue during Level I testing, but during Level II testing, produced a positive reaction to deer (Plate 19:h). This result could be explained by a number of factors. First, the areas of the biface that were tested during the Level I analysis were not the same as those tested during the Level II analysis. Second, the same areas were tested, but the Level I analysis removed sediments from the biface that did not contain blood residue. For example, the Level I testing solution could have been made from sediments that were adhering to the biface but that did not actually come from its surface--that is, the interface between the stone and the adhering sediments. Third, all conditions of testing were the same, but the Level I test results were misread or a defective chemstrip was used.

Whatever the case, it is clear that presence-absence testing with chemstrips is *not* an effective method for predicting which artifacts will produce positive results at the family level. From a budgetary standpoint, it is true that more artifacts can be tested for the same amount of money with the presence-absence approach, but the results are less specific than the family approach. Because the amount of residue adhering to any one artifact is limited, the most prudent use of that residue would be to limit its use to family-level or species-level testing.

In discussing subsistence, only the family-level test results are considered. Deer was detected on four bifaces, rabbit on two bifaces, dog on two bifaces, guinea pig on one biface, bovine on one biface, bear on one endscraper, and chicken on one early-reduction flake (Table 22). That bifaces tested positive more often than other tool types is a predictable result because they account for 66 percent of the sample. Overall, the results indicate that deer were an important resource to the inhabitants of Site 7S-F-68, and

TABLE 22: LEVELS I AND II BLOOD RESIDUE ANALYSIS RESULTS

ARTIFACT CLASS	CATALOG NO.	LEVEL I RESULTS	LEVEL II RESULTS
Biface	49	-	Deer
	50	-	Negative
	60	-	Negative
	67	-	Deer and Rabbit
	68	-	Deer
	73	-	Negative
	102	-	Negative
	133	-	Dog
	160	-	Negative
	193	-	NSR
	200	-	Guinea Pig
	242	-	Negative
	262	-	Negative
	380	-	Negative
	425	-	Bovine
	455	Absent	Negative
	484A	-	Dog
	484B	-	Negative
	502	Absent	Negative
	541	Absent	Negative
	544	Absent	NSR
	579	-	Negative
	706	Absent	Negative
	725	-	Rabbit
	874	-	NSR
	875	-	NSR
	884	-	Negative
	893	-	Negative
	910	-	NSR
	926	Absent	Deer
	960	-	Negative
	1037	Absent	Negative
	1353	Present	Negative
Uniface	59	Absent	Negative
	125	-	Negative
	262	-	Bear
	329	Absent	Negative
	354	-	Negative
	610	-	Negative
	967	Absent	Negative
Core	775	-	Negative
	1025	Absent	Negative
Debitage	574	Present	Negative
	897	Present	Negative
	902	Present	Negative
	1002	Present	Negative
	1021	Present	Negative
	1231	Present	Chicken
Cobble Tool	508A	Absent	Negative
	508B	Absent	Negative

NSR: nonspecific reaction.

also that a broad range of fauna were taken for food and/or materials: large-game animals (deer, bear, and bison or possibly elk), small-game animals (rabbit, beaver or squirrel, and wolf or fox), and upland game birds (wild turkey or grouse or quail). A preference for upland game is evident, especially considering that although the family-level analysis included antisera for duck and trout, none of the artifacts tested positive for either of these taxa. Perhaps this preference is linked to the site's location and function; Site 7S-F-68 could have served as a campsite for groups hunting upland game and/or gathering plant resources.

This is, however, a composite view of subsistence. A number of different components are represented by the artifacts that tested positive: Early Archaic points (N=3) tested positive for deer, dog, and guinea pig (Plate 10); a Middle Archaic point tested positive for deer and rabbit (Plate 11); Late Archaic points (N=2) tested positive for rabbit and bovine (Plate 12); and a Late Woodland point tested positive for dog (Plate 14). A larger sample of temporally diagnostic artifacts with positive results would help to clarify subsistence patterns. Even so, the composite view may reflect a basic, unchanging pattern of use. The site might have been an important campsite and staging area for exploiting upland fauna and flora throughout much of prehistory.

G. SUMMARY AND CONCLUSIONS

The five research topics outlined at the beginning of the chapter have been examined to varying degrees in the preceding pages. Below, each topic is briefly summarized.

The investigation of site chronology resulted in the identification of five components: Paleoindian, Early Archaic, Middle Archaic, Late Archaic/Early Woodland, and Late Woodland. A minor Middle Woodland component may also be present. The occupants of each of these components appear to have used the site as a temporary campsite, probably while they were in the area hunting and/or collecting plant foods. The Early Archaic and Late Archaic/Early Woodland components were the most intensive occupations, and the former appears to have been slightly more intense than the latter.

Analysis of the site's internal patterning has permitted recognition of a number of possible activity areas, represented by concentrations of raw materials and tools. Although there was only limited evidence of Paleoindian occupation of the site, the assemblage of crystal quartz tools and debitage associated with this component was concentrated in a small area on the western margin of the site.

Deposits associated with the Early Archaic occupation(s) of the site were concentrated in the South Excavation Block and were apparently associated with a formal cooking/heating area represented by a concentration of FCR (Feature 31) and a milling area consisting of a mano and metate (Feature 22). While the Early AU spatial distributions showed a consistent pattern of projectile points, debitage, and cobble tools in the South Block, it is also interesting that the unifacial tools associated with these contexts were more widely distributed over the site area, possibly representing secondary activity areas used for tasks such as hide processing. Feature 21, an activity area consisting of a cobble chopper and hoe, probably belongs to the site's Early Archaic component.

The distribution of Late Archaic/Early Woodland points also exhibited a distinct spatial pattern, with most points located in the North Excavation Block, suggesting a shift in the primary occupation area within the site. Identification of spatial patterning associated with the Late Woodland component was limited by the fact that the Late AU contexts had been subjected to various post-depositional disturbances.

Although the site appears to have served the same basic function for each component, different raw material procurement strategies indicate that some groups ranged farther than others for raw material; thus, it can be suggested that their settlement patterns were more wide ranging. The Middle Archaic (Otter Creek) component appears to have been the most wide ranging. In contrast, the Late Archaic/Early Woodland component may have been the least mobile because, as it has been argued, these groups procured lithic raw materials through exchange networks. Little can be inferred about subsistence beyond the observation that all or most the components appear to have been interested in local plant foods and upland game.

It must be stressed in conclusion that the preceding interpretations are biased--they represent primarily the "lithic view" of the site. Stone tools were an important part of the overall technology and economy of the Archaic and Woodland groups that briefly inhabited the site; yet these implements furnish only certain kinds of information. With new techniques, such as residue analysis, stone tools and debris may provide archaeologists with additional avenues with which to study the economies of extinct cultures.

VIII

FLORAL AND FAUNAL ANALYSIS

A. INTRODUCTION

A small amount of charred botanical material was derived from Site 7S-F-68. Despite its paucity, however, the identified material has qualitative interpretive value. The charred specimens recovered from the site represented five native plant types for which there is ethnographic documentation of usage by Native American populations: woodbine, sumac, sumpweed, hickory, and cherry. Woodbine was utilized by Native Americans as a medicinal herb and sumac as a dye, as a medicinal herb, for cordage and as a smoking material. There is documented ethnographic usage of cherry both for food and as a medicinal. Hickory nuts were used as food, and the shells were utilized for hot smokeless fires. All of these plant types could have provided motivation for seasonal exploitation of this site area. However, the charred sumpweed was the most significant of the botanical material recovered from the site area.

Sumpweed is an indigenous annual seed plant which played a prominent role in eastern North America in the transition from the sole dependence of human groups on hunting and gathering of wild plants to cultivation. Among the most notable artifact finds from the site were a mano and metate, and their recovery raises the question as to what was being processed with these tools. The kernels of sumpweed are not easy to extract from their surrounding pericarps and the milling stones may have provided the technology to process sumpweed into a palatable food.

The floral and faunal data suggest that the site area could be functionally categorized as a procurement site. The limited amount of charcoal and fire-cracked rock is not indicative of prolonged and sustained use of hearth areas, which would be consistent with intermittent site use. The scant recovery of faunal material does not suggest hunting to have been the primary purpose or focus of this procurement site. The charred floral specimens exhibit a pattern of autumn use of the site. Overall, the data suggest that this location was utilized as a procurement site during the months of September and October for collection of seasonally available botanicals.

B. SAMPLES STUDIED

The floral investigation of Site 7S-F-68 was conducted in two phases, and involved a total of 50 samples (Table 23). In the initial, exploratory phase of analysis, a total of 23 flotation samples were examined from a total of 44 liters of soil, primarily originating from non-feature contexts. In the second phase of analysis, an additional 27 flotation samples were examined. The samples examined include all prehistoric features that provided sufficient soil, and a variety of non-feature contexts representing the North Excavation Block, the South Excavation Block, and outlying units. The fifteen features provided samples ranging from 1.0 liter to 23.0 liters in size, comprising a total volume of 65.1 liters. Five 2.0-liter control samples were also examined from off-site contexts to provide a mechanism for examination of potential vegetational differences between the prehistorically exploited area and the nonexploited area.

No faunal material was recovered from flotation samples. However faunal specimens, as well as additional floral specimens, primarily charcoal, were recovered during excavation.

C METHODOLOGY

1. *Floral*

Soil samples were removed from selected contexts and air-dried prior to processing. The samples were processed in a specially designed drum that provides a continuous froth of water to dissolve the soil, yielding a light fraction and a heavy fraction. The recovery of cultural and biological material during flotation processing is dependent on the size of the mesh used. A fine-mesh polyester "bridal veil" was used for the heavy fraction and an even finer-meshed silk screen fabric was used for the bags to collect the light fraction.

As a control, 100 charred and 100 uncharred poppy seeds were added to one sample prior to flotation. A poppy seed recovery test was used to test effectiveness and consistency of flotation procedures. Poppy seeds range in size from 0.7 mm to 1.4 mm and are of an appropriate size to test the effectiveness of micro seed recovery. The recovery rate is a measure of seed loss, damage, and inter-sample contamination. No contamination was noted and recovered control seeds were not fragmented. The control seed recovery rate was 16 percent for a two liter sample. The low recovery of control seeds might suggest that small seeds are not well represented within the samples. However,

Table 23: Flotation Samples Examined

CAT. NO.	UNIT	STRAT.	LEVEL	QUAD.	FEAT.	SIZE (l)	AU
309	E.U. #28	.	2	SW	18	2.0	M
311	E.U. #28	.	.	.	16	2.0	M
332	E.U. #25	B	3	NE	17	2.0	M
361	E.U. #35	B	2	NE	.	2.0	M
365	E.U. #35	B	3	NE	.	2.0	M
369	E.U. #35	B	4	NE	.	2.0	M
373	E.U. #35	B	5	NE	.	2.0	E
377	E.U. #35	B	6	NE	.	2.0	E
381	E.U. #35	B	7	NE	.	2.0	E
385	E.U. #35	B/C	8	NE	.	2.0	E
389	E.U. #35	C	9	NE	.	2.0	E
479	E.U. #38	.	4-6	.	19	2.0	E
508	E.U. #42	.	.	.	22	2.0	E
541	E.U. #48	.	.	.	21	3.0	E
545	E.U. #21	B	2	NE	.	2.0	M
549	E.U. #21	B	3	NE	.	2.0	M
553	E.U. #21	B	4	NE	.	2.0	M
557	E.U. #21	B	5	NE	.	2.0	E
561	E.U. #21	B	6	NE	.	2.0	E
566	E.U. #21	.	.	.	23	4.0	M
567	E.U. #21	B	7	NE	.	2.0	E
586	E.U. #47	A	1	.	20	13.0	L
649	E.U. #29	.	.	.	26	23.0	L
737	E.U. #49	.	.	.	24	3.0	M
765	E.U. #39	B	2	NE	.	2.0	M
769	E.U. #39	B	3	NE	.	2.0	M
773	E.U. #39	B	4	NE	.	2.0	E
780	E.U. #39	B	6	NE	.	2.0	E
784	E.U. #39	B	7	NE	.	2.0	E
786	E.U. #39	B	5	NE	.	2.0	E
787	E.U. #39	.	.	.	28	2.0	E
909	E.U. #45	.	.	.	25	4.3	M
1002	E.U. #52	B	5	.	31	6.0	E
1114	E.U. #18	B	.	.	8	2.0	NA
1156	E.U. #23	.	.		7	2.0	NA
1227	E.U. #49	.	.	.	24	2.0	E
1310	E.U. #41	B	2	NE	.	2.0	M
1312	E.U. #41	B	3	NE	.	2.0	M
1316	E.U. #41	B	4	NE	.	2.0	E
1320	E.U. #41	B	5	NE	.	2.0	E
1324	E.U. #41	B	6	NE	.	2.0	E
1328	E.U. #41	B	7	NE	.	2.0	E
1332	E.U. #41	B	8	NE	.	2.0	E
1334	E.U. #41	B	9	NE	.	2.0	E
1336	E.U. #41	B	10	NE	.	2.0	E
OFF-SITE CONTROLS							
9991	STP #C1	C	.	.	.	2.0	NA
9992	STP #C2	C	.	.	.	2.0	NA
9993	STP #C3	C	.	.	.	2.0	NA
9994	STP #C4	B	.	.	.	2.0	NA
9995	STP #C5	B	.	.	.	2.0	NA
TOTAL NUMBER OF SAMPLES: 50				TOTAL VOLUME:		144.3	

carpetweed seeds are smaller than poppy seed and are well represented within the site. Carpetweed seeds were found in abundance in many samples and were identified in three fourths of the analyzed soils samples.

Examination of biological materials was made with a binocular dissecting microscope. Each of the samples was systematically scanned and floral specimens were identified and charred specimens counted. Uncharred specimens were identified and noted as present but were not counted because of their limited analytical significance. Each charred floral specimen was given a count value of one. When possible, charred wood specimens were counted and weighed in grams. Unfortunately most charred wood fragments were so small that weighing and counting were not feasible. Catalog sheets indicate the count value of charred specimens recovered from both phases of analysis. The tables and text discuss charred as well as uncharred specimens recovered from both phases of analysis.

Floral material was identified to the species level where possible. Confirmation of species was aided by the use of an extensive type collection of floral material and reference materials (Cox 1985; Fernald 1970; Gunn 1970; Lawrence and Fitzsimons 1985; Martin 1972; Martin and Barkley 1961; Mohlenbrock 1980,1981; Peterson 1977; Renfrew 1973).

a. *Quantification of Floral Data*

Quantifying botanical data by absolute counts of plant types in each sample is problematic because absolute frequencies may reflect preservation, sampling, or other factors. Absolute frequencies must be viewed with particular caution at this site because so few charred, potentially prehistoric seed specimens were recovered.

A ubiquity analysis was performed for the site area under study. A ubiquity analysis disregards the absolute count of a recovered plant type and instead looks at the number of samples in which the plant type appears within a group of samples. Each botanical species is scored as present or absent in each sample (Popper 1988:60-64). The species is considered present whether the sample contains 1 or 500 specimens. The Ubiquity Score of a plant type is the number of samples in which the plant type is present, expressed as a percentage of the total number of samples in the group. Although 50 flotation samples were examined, 2 of those samples contained no biological material. Other botanicals, including charcoal and material produced during excavation, were recovered from 11 additional excavation contexts, but they were not included in the ubiquity analysis. Therefore, 48 samples is the base number on which the scores are based. For example, charcoal fragments were observed in 35 of the 48 samples, giving charcoal fragments a Ubiquity Score of 73 percent. Uncharred sedge seeds were recovered from 13 of the 48 sample, giving that species a Ubiquity Score of 27 percent. Table 24 lists the Ubiquity Scores for the site.

In a ubiquity analysis, the score for of one genus does not affect the score for another, and therefore the scores for different plant species may be evaluated independently. The scores may suggest the relative importance or abundance of plant types, and the Ubiquity Scores of uncharred plant types can suggest their prominence within the "site landscape." The Ubiquity Scores for charred specimens suggest their importance in prehistoric utilization as well as their botanical prominence within the "site landscape." The assumptions made for a ubiquity analysis are that all samples in a group are independent. Since sample sizes are not constant, variation in sample size does not inflate the frequency scores of the botanical families in larger samples.

b. *Delineation of Prehistoric Specimens*

Distinguishing prehistoric specimens from historic specimens or natural seed rain was the first focus of analysis. To be given consideration as a potential prehistoric floral specimen, two important criteria have to be met. The first and foremost criterion is the botanical history of each plant recovered. Plants which are not native to America obviously were not available to prehistoric populations.

The second important criterion is that seed specimens have to have been modified in a manner that allows preservation of what is really a biodegradable material. Investigators generally consider only charred seed specimens as useful and legitimate constituents of a prehistoric archaeological floral assemblage (Minnis 1981:147; Quick 1961:94-99) because, given normal soil conditions, seeds will either fulfill their reproductive function or will decay. The dormancy period for most plants is rarely more than 100 years (Harrington 1972); therefore, in order for a seed to survive in the archaeological record it must short-circuit the reproductive function, i.e., by charring. Although desiccation is another way in which seeds can circumvent decomposition, the environment of the northeastern United States makes the desiccation of seeds a very unlikely occurrence.

All factors that influence preservation must be considered because archaeological plant remains are neither a large nor representative sample of the diet. At an open site in a temperate environment, very little plant material is ever preserved. As discussed above, the material must become charred in order to evade microbial action, a process that requires special circumstances and rarely happens. The specimen must first find its way into a fire and ignite. Then it must be withdrawn from the flames quickly before it turns to ash, or it must be buried so deeply in the coals that there is insufficient oxygen for complete combustion (Keene 1981:183; Wetterstrom 1978:111-112). Following charring, the specimen must be protected from the elements and from other disturbance in order to remain intact for succeeding centuries. Finally, it must endure the excavation process and the flotation procedure. Clearly, hard items such as nutshell are favored whereas soft items are not.

TABLE 24: UBIQUITY INDEX OF FLORAL SPECIMENS

CAT. NO.	Carpetweed	Purslane	Chickweed	Oxalis	Knawel	Thistle
309	X	.	.	.		.
311	X	.	.	.	X	.
332	.	.	.	.	X	.
361	X	.	.	.	X	.
365	X	.	X	.	.	.
369	.	.	.	.	.	.
373	X	.	.	.	X	.
377	X	.	.	.	.	.
381	X	.	.	.	.	.
385	.	.	.	.	X	.
389	.	.	.	.	X	.
479	X	.	.	.	.	.
508	X	.	.	.	X	.
541	X	.	.	.	.	.
545	X	.	.	.	X	.
549	X	.	.	.	.	.
553	X	.	.	.	.	.
557	X	.	.	.	.	.
561	X	.	.	.	.	.
566	X	.	.	.	.	.
567	.	.	.	.	.	.
586	X	.	.	.	.	.
649	.	.	.	.	.	.
737	.	.	.	.	X	.
765	X	.	.	.	X	.
769	X	X	.	.	X	.
773	X	.	.	.	X	.
780	.	.	.	.	.	.
784	X	.	.	.	X	X
786	X	.	.	X	X	.
787	X	.	.	.	X	.
909	X	.	X	.	X	.
1002	X	.	.	.	X	.
1114	X	.	.	.	X	.
1156	X	.	.	.	X	.
1227	X	.	.	.	.	.
1310	X	.	.	.	.	.
1312	X	.	.	.	.	.
1316	X	.	.	.	.	.
1320	X	.	.	.	.	.
1324	X	.	.	.	X	.
1328	X	.	.	.	X	.
1332	X	.	.	.	X	.
1334	.	.	.	.	.	.
1336	X	.	.	.	X	.
9991	X	.	.	.	.	.
9994	.	.	.	.	.	.
9995	.	.	.	.	.	.
INDEX	63%	2%	3%	2%	39%	2%

X: specmen present; *X* : charred specimen

Table 24--Continued

CAT. NO.	Chenopodium	Amaranthus	Knotweed	Pokeweed	Sedge	Chufa
309	.	.	.	.	.	.
311	.	.	.	.	.	X
332	.	.	.	.	X	.
361	X	.	X	.	.	.
365	X	.	.	.	.	.
369	X	.	.	.	.	.
373	.	.	.	.	.	.
377	.	.	.	.	.	.
381	X	.	.	.	X	.
385	X	.	.	.	.	.
389	.	.	.	.	.	.
479	.	.	.	.	.	.
508	.	.	X	.	.	.
541	.	X	.	.	.	.
545	.	.	.	.	X	.
549	.	.	.	.	.	.
553	.	.	.	.	X	.
557	.	X	.	.	.	.
561	.	.	.	.	.	.
566	.	.	.	.	.	.
567	.	.	.	.	.	.
586	.	.	.	.	.	.
649	.	.	.	.	.	.
737	.	.	.	.	.	.
765	X	.	.	X	X	.
769	.	.	.	X	.	.
773	.	.	.	.	.	.
780	.	.	.	.	X	.
784	X	.	.	.	.	.
786	.	.	.	.	.	.
787	.	.	.	.	.	.
909	.	.	.	X	.	.
1002	X	.	.	.	X	.
1114	.	.	.	.	.	.
1156	.	.	.	.	X	X
1227		.	.	.	X	.
1310	X	.	.	.	X	.
1312	X	.	.	.	.	.
1316	.	.	.	.	.	.
1320	X	.	.	.	.	.
1324	.	.	.	.	.	.
1328	.	.	.	.	X	.
1332	.	.	.	.	X	.
1334	.	.	.	.	.	.
1336	.	.	.	.	.	.
9991	.	.	.	.	.	.
9994	.	.	.	.	.	.
9995	.	.	.	.	X	.
INDEX	19%	3%	3%	5%	22%	3%

X: specmen present; *X* : charred specimen

TABLE 24--CONTINUED

CAT.NO.	Flatsedge	Grass	Spurge	Blackberry	Deerberry	Paspalum	Doveweed
309	X	X	.	.	.	.	.
311	X	X	.	.	.	.	.
332	.	X	.	.	.	.	.
361	X	.	X	.	.	X	.
365	X	.	.	X	.	.	.
369	X	.	.	.	.	.	X
373	.	.	.	.	.	.	.
377	.	X	.	.	.	.	.
381	X	X	.	.	.	.	.
385	.	X	.	.	.	.	.
389	.	X	.	.	.	.	.
479	.	X	.	.	.	.	.
508	.	.	.	.	.	.	.
541	X	.	.	.	.	.	.
545	X	X	.	.	X	.	.
549	X	X	.	.	.	.	.
553	.	.	.	.	.	.	.
557	X	.	.	.	.	.	.
561	X	X	.	.	.	.	.
566	X	X	.	.	.	.	.
567	X	.	.	.	.	.	.
586	.	X	.	.	.	.	.
649	.	.	.	.	.	.	.
737	.	X	.	.	.	.	X
765	X	X	.	.	X	.	.
769	X	X	X	.	.	X	.
773	X	X	.	.	.	X	.
780	.	X	.	.	.	.	.
784	.	X	.	.	.	.	.
786	X	X	.	.	.	.	.
787	X	X	.	.	.	.	X
909	X	X	.	.	.	.	X
1002	X	X	.	.	.	.	.
1114	X	.	.	.	.	.	.
1156	X	X	.	.	.	.	.
1227	.	X	.	.	.	.	.
1310	.	X	.	X	.	.	.
1312	.	X	.	.	.	.	.
1316	.	X	.	.	.	.	.
1320	X	X	.	.	.	.	.
1324	.	X	.	.	.	.	.
1328	X	X	.	.	.	.	.
1332	X	X	.	.	.	.	.
1334	.	X	.	.	.	.	.
1336	.	X	.	.	.	.	.
9991	.	.	.	.	.	.	.
9994	.	.	.	.	.	.	.
9995	X	.	.	.	.	.	.
INDEX	44%	58%	3%	3%	3%	5%	7%

X: specmen present; *X* : charred specimen

TABLE 24--CONTINUED

CAT.NO.	Cress	Chokecherry	Dodder	Woodbine	Sumac	Sumpweed	Charcoal
309	.	.	.	.	.	.	*X*
311	.	.	.	.	.	.	*X*
332	.	.	.	.	.	*X*	*X*
361	.	.	.	.	.	.	*X*
365	.	.	.	.	.	.	*X*
369	.	.	.	.	.	.	.
373	.	.	.	.	.	.	.
377	.	.	.	.	.	.	*X*
381	.	.	.	.	.	.	.
385	.	.	.	.	.	.	.
389	.	.	.	.	.	.	.
479	.	.	.	.	.	*X*	*X*
508	.	.	.	.	.	.	*X*
541	.	.	.	.	.	.	*X*
545	.	.	.	X	.	.	*X*
549	.	.	.	.	.	.	*X*
553	.	.	.	.	.	.	*X*
557	.	.	.	.	.	.	*X*
561	.	.	.	.	.	.	*X*
566	.	.	.	*X*	.	.	*X*
567	.	.	.	X	.	.	*X*
586	.	.	.	.	.	*X*	*X*
649	.	.	.	.	*X*	*X*	*X*
737	.	.	X	.	.	.	.
765	.	.	.	.	.	.	*X*
769	.	.	.	.	.	.	*X*
773	.	.	.	.	.	.	*X*
780	.	.	.	.	.	.	*X*
784	.	.	.	.	.	.	*X*
786	.	.	.	.	.	.	*X*
787	.	.	.	.	.	.	*X*
909	.	.	.	.	.	.	*X*
1002	.	.	.	.	.	.	*X*
1114	.	.	.	.	.	.	*X*
1156	.	.	.	.	*X*	.	*X*
1227	.	.	.	.	.	.	*X*
1310	.	.	.	.	.	.	.
1312	.	.	.	.	.	.	*X*
1316	.	.	.	.	.	.	*X*
1320	.	.	.	.	.	.	*X*
1324	.	.	.	.	.	.	*X*
1328	.	X	.	.	.	.	*X*
1332	.	X	.	.	.	.	.
1334	.	.	.	.	.	.	
1336	X	.	.	.	.	.	.
9991	.	.	.	.	.	.	.
9994	X	.	.	.	.	.	.
9995	.	.	.	.	.	.	.
INDEX	3%	3%	2%	5%	3%	7%	75%

X: specmen present; *X* : charred specimen

Plant parts can be categorized into three types: (1) dense inedible parts such as nutshell or fruit pits that might be discarded in or near a fire; (2) moderately dense parts such as small seeds which might be consumed and would only be burned or buried accidentally; and (3) parts with no density and a high water content, such as tubers and greens, which would be consumed and which are unlikely to carbonize under normal circumstances (Keene 1981:183).

It cannot be assumed that carbonized plant remains accurately reflect the diet of the site occupants, because charring is a fortuitous event. While it may be assumed that the uncharred specimens within the samples are not prehistoric in origin, charring alone does not impart unequivocal prehistoric status to a seed specimen. All charred seeds within a sample are not necessarily of prehistoric origin, as it is not uncommon for modern seeds to become incorporated into prehistoric assemblages. Vertical seed dispersion can occur from plowing, root holes, drying cracks, downwashing, and from earthworms and other burrowing animals (Keepax 1977; Minnis 1981:145; Smith 1985). These processes crosscut cultural depositional processes.

c. *Sources of Prehistoric Seeds*

There are several sources of prehistoric seeds recovered from archaeological contexts. The most widely considered source is direct utilization of the seeds. Many botanical artifacts are the result of the collection, processing, and use/consumption of plant resources. Accidents in processing, burning of debris, and the burning of stored materials are the most common actions which result in the direct evidence of seed use (Minnis 1981:145). Few plant parts will be deliberately burned in a fire, because most plant refuse is too wet to burn readily, or it may smoke or smell if burned. However, the medicinal utilization of plants whereby the leaves or roots were sprinkled on hot stones or boiled or steeped in water could result in charred seed remains. The lining of cooking pits with large leaves could also result in charred seed remains.

Another potential source of archaeological seeds is the accidental preservation of the prehistoric seed rain that is unrelated to any cultural use of the seeds or plant. Naturally dispersed seeds can blow into hearths or be burned on trash middens. Plants can also become carbonized when vegetation is burned off by man or by natural means. Day (1953) has documented that many aboriginal groups in eastern North America manipulated local vegetation by the use of fire. Intentional burning of forest cover and second growth to clear land for agricultural or hunting purposes was done to clear campsites, increase visibility, facilitate movement, eliminate rodents, enhance soil productivity, and promote the growth of certain plants.

The amount of plant food used by a prehistoric population may be poorly represented in the archaeological record (Keene 1981). Because of the vagaries of survival for plants brought to open sites, quantitative summaries should be viewed with this in mind.

2. *Faunal*

Bones and bone fragments from the site were identified anatomically and speciated with the aid of a comparative faunal collection and reference materials (Chaplin 1971; Cornwall 1956; Gilbert 1973; Morris 1975; Olsen 1964, 1968, 1979; Ryder 1969; Schmid 1972). Each bone fragment was counted and weighed in grams. Bone modification by burning was noted according to whether the specimen was charred to a black, gray, or white condition. Bones were measured according to von den Driesch (1976). Measurements were recorded in millimeters or centimeters.

a. *Variables Affecting Bone Survival*

Bone, horn, teeth, antler, and shell are the most abundant faunal remains recovered in archaeological investigations. Bone is made up of calcium phosphate, lesser quantities of calcium carbonate, and other trace elements and compounds. The mineral salts impart a rigidity and hardness to the bone, while the organic compounds give it resilience and toughness (Carbone and Keel 1985:1-19). Because of bones' organic content, it is subject to insect, fungal, and rodent attack, both in and out of the soil (Carbone and Keel 1985:1-19). Since microorganisms have been shown to be one of the primary causes of decay, it stands to reason that an analysis of the environmental tolerance of these organisms will give insight into the kinds of situations that are favorable to preservation of animal remains. The conditions that are favorable to preservation are those that are reflected in daily kitchen rounds. Boiling, freezing, pickling, and salting inhibit decay.

Soil acidity also has an impact on bone preservation. If the environment is acidic then the mineral content will be removed. Neither bone nor shell will survive under conditions where the pH is lower than 6.3, and samples from the site had mean pH value of 5.0. In considering the preservation of bone the effects of humans must be taken into account, because culturally modified bone, whether boiled or cracked, will be more susceptible to environmental forces (Carbone and Keel 1985:14). The effect of the chemical environment on teeth will be somewhat muted since dentine, although chemically similar to bones, contains less organic matter and more phosphate and carbonate.

Enamel, which is the hardest component of teeth, contains the least organic matter and is still more resistant. Teeth will be affected by acidic conditions in the soil but are more likely to be found preserved; generally, however, they will be somewhat etched (Carbone and Keel 1985:14).

Fire is an agent which can impact faunal material, not only because it can cause damage directly but also because it interacts with other agents to enhance destruction. Fire can alter chemical properties of soils such as pH, and the content of nitrogen, potassium, and sulfur (Wildesen 1982:68). Burning of bones may result as a byproduct of roasting, or from disposal in a hearth. Accidental or purposeful exposure of bone to fire alters the calcium content of bone. If a fresh bone is burned it does not necessarily become altered in shape, but it does lose weight and becomes very friable. The destruction of organic material in bone through burning can shrink it from 5 percent to 15 percent and reduce its weight by 50 percent (Wing and Brown 1979:109).

b. *Bone Modification*

Of the faunal elements recovered from Site 7S-F-68, a total of 106 were charred. Burned bone indicates direct contact with fire or coals. Heat can result in the blackening of bone. Deeply blackened bone may suggest that flesh was still present during the burning (Brothwell 1971:19). Charring of bone during roasting is confined to the exposed ends of the bone not protected from the fire by meat. Burning at high temperatures for prolonged periods can leave the bone pure white, friable, soft, and porous, suggesting complete oxidation. Some burned bone that is not completely calcined does not reach the fragile state and although light in weight, may be quite strong (Carbone and Keel 1985:7).

Burned bone ranges in color from white through grays and blues to black, depending on the completeness of combustion (Wing and Brown 1979:109). Approximately one half of the bones of the assemblage were not charred at all, and the remainder were whitened. One bone specimen was blackened. A bone assemblage diverse in charred color might suggest uneven exposure of the bone to the fire. Bones exposed to repeated and prolonged fires would exhibit more modification than bones left in the hearth area for a short period of time. The color variations of the burned specimens at this site do not suggest a pattern of successive fires.

3. *Computer Entry of Data*

The cataloging procedures for data were such that the first delineation of data was made in the category called "Specimen." Latin species nomenclature for floral data was entered. This category indicates the level of identification, according to whether the precise species and family could be determined. Charcoal fragments were listed as Floral in this category. Faunal specimens was listed as mammal, bird, or mammal/bird. These general categorizations were used because the specimens could not be identified more precisely. The next data entry category is "Element." The range of entries in this category includes the precise skeletal element ,such as phalanx fragment ,or a less precise element definition, such as longbone fragment. Nondiagnostic appears in this category when the skeletal element of the specimen could not be determined.

Each entry includes both a count and weight, with weights expressed in grams. Charring was recorded for both floral and faunal specimens; for bone, the color the bone turned after charring was recorded in this field. Measurements of longbone length were recorded in centimeters. Other information was recorded in a "Remark" field, including the notation "SL," indicating that the bone was split longitudinally, and whether the specimen was derived from excavation or flotation samples.

D. FLORAL ANALYSIS

A total of 27 plant species were recovered from the samples under study (Table 24). Nearly the entire recovered floral assemblage, with the exception of charcoal, consisted of material in the uncharred state which disallows consideration for prehistoric status. The uncharred assemblage was comprised of ground cover (grass, sedge, carpetweed, flatsedge, paspalum, thistle, and chufa) and plants commonly found in open woods, thickets, and clearings (knotweed, knawel, chenopodium, deerberry, pokeweed, purslane, spurge, doveweed, oxalis, dodder, sumac, chickweed, woodbine, cress, chokecherry, Amaranthus, and blackberry). The charred specimens included charcoal fragments, woodbine, sumac, and sumpweed. Cherry, hickory, and unidentified nutshell fragments were recovered in the charred state from excavation. These items are not included in Table 24, which delineates the specimens derived from flotation, but are discussed in the text.

1. *Off-Site Samples*

Five off-site samples were examined from an area south of the site to provide a control during analysis. Two of the five samples contained no biological material (STP 2 and STP 3), a finding which was in sharp contrast to the site samples, which all contained biological material. In one of the off-site samples (STP 1), only carpetweed was identified, and carpetweed was prevalent within the site area. Flatsedge and sedge were recovered from STP 5, and both of these plants were also identified in samples taken from within the site. Cress was identified from STP 4 and from one context within the site boundaries. The most striking contrast between the off-site controls and the site samples was that the off-site controls contained fewer species.

2. *Uncharred Non-Native Species*

The floral assemblage contained five seed types which are not native to America. One additional seed type was identified to the genus level but has both native and introduced species.

a. *Carpetweed*

Carpetweed *(Mollugo verticillata)* is an annual weed with a deep taproot which became naturalized throughout North America from tropical America (Cox 1985; Fernald 1970). It is not an early spring plant; germination usually occurs later in the season when conditions are more like those of its warmer native habitat. Its late start is compensated for by a very rapid rate of growth in summer and fall, when it becomes a nuisance in cultivated areas. It is a common weed in a variety of environmental settings. Although the plant can be cooked and eaten as a potherb, it was not available to native populations. This combination of being uncharred and not native provided a fairly straightforward elimination of this plant type from consideration for potential prehistoric utilization. Carpetweed had a Ubiquity Score of 77 percent.

b. *Purslane*

It is widely believed that purslane *(Portulaca oleracea)* became naturalized after its introduction to this continent from Europe (Fernald 1970; Knap 1979; Peterson 1977). Botanists generally believe that purslane, a native plant of India, was adopted as a choice vegetable in Europe and was brought to America with the first settlers. It was apparently adopted by native North Americans, who used the ground seeds as a breadstuff and meal. However, it is interesting to note that *Portulaca* is mentioned in an Icelandic medical manuscript of 1475 as a medicinal plant. Yarnell (1964) reported finding *Portulaca* in North American archaeological contexts from 3000-2500 BC and considers that it spread to North America by Indian use. Erichsen-Brown states that despite "all of this evidence the leading eastern American taxonomic botanists today still refuse to recognize Portulaca as an indigenous plant" (Erichsen-Brown 1979: viii). The recovered purslane specimens were not in the charred state, and, based on that factor rather than its botanical history, it will not be considered prehistoric in origin. Purslane was found only in one context and has a Ubiquity Score of 2 percent.

c. *Chickweed*

Chickweed *(Stellaria media)* was introduced from Europe and is now a common plant in North America. Presumably, chickweed gets its name from the fact that domestic chicks as well as doves, quail, and sparrows favor it as a dietary item. Seeds maintain their viability after passing through the digestive tract; therefore, birds and mammals that eat the plant serve as agents of dispersal. It is likely that while importing desired plants, the colonists also imported some weeds. In fact, a traveler in 1740 reported that old English garden weeds such as motherwort, froundsel, chickweed, and wild mustard had clung to the Englishman wherever he trod (Earle 1974). Chickweed thrives in a variety of environmental settings. Chickweed was recovered from only two contexts and has a Ubiquity Score of 4 percent.

d. *Oxalis*

Oxalis (*Oxalis* spp.) is a biennial thoroughly established in eastern North America but is a native of Europe and Asia (Cox 1985:240). Oxalis is sometimes called wood sorrel. The leaves are edible and have a pleasant acidity (Hedrick 1972:400-401). Oxalis is widespread in open woods, moist woods, and banks (Peterson 1977:104). Oxalis was recovered from only one context and has a Ubiquity Score of 2 percent.

e. *Knawel*

Knawel (*Scleranthus annus*) is a branched spreading weed introduced from Europe. It is found in woods, fields, roadsides, and waste places (Fernald 1970:612). Knawel was recovered from 23 samples and has a Ubiquity Score of 48 percent.

f. *Thistle*

It could not be ascertained if the thistle recovered within the site was a native or introduced species. Of the twelve species of thistle in North America, only one is a native species. Thistle (*Cirsium* spp.) is a biennial with prickly leaves. With the spines removed, the young leaves can be eaten raw or cooked as greens. The pithy young stems are excellent peeled and eaten raw or cooked. The raw or cooked roots of the first year plants are good. Young leaves, young stems, and roots would be available at their best in the spring and fall (Peterson 1977:126). Thistles are adaptable and found in numerous environmental settings. There are references to thistle being eaten by historic Native American populations. In fact, *Cirsium edule* is referred to as Indian Thistle (Medsger 1966:200). The Ubiquity Score for Thistle was 2 percent.

3. *Uncharred Native Specimens*

The uncharred specimens in the site assemblage are considered modern in origin and representative of the present-day environmental conditions. Despite the fact that the following native species were recovered in the uncharred state, it is possible that some of these plant species would have been present in the prehistoric landscape and utilized by the prehistoric populations exploiting this area. Many of the recovered uncharred native botanicals have been found in archaeological contexts in the eastern United States.

a. *Chenopodium*

Chenopodium is a diverse, worldwide genus of which some 20 species occur in the eastern United States and Canada (Hatch 1980:206). Opportunistic weeds such as Chenopodium, knotweed, and Amaranthus were potentially important plant food for Late Archaic populations (Asch and Asch 1977; Asch et al. 1972; Baker 1980; Ford 1977, 1985; Wilson 1976; Winters 1969). In the spring, weedy genera are available for greens and in the late autumn they are prolific seed bearers. Indians harvested Chenopod seeds by pulling up the entire plant and placing it in a sack. After the plant dried, the seeds fell to the bottom of the sack and were then parched for storage and later crushed in a mortar. The meal was added to breads or cooked in a porridge (Wetterstrom 1978:110). Chenopodium *(Chenopodium* spp.*)* has been recovered in archaeological contexts in eastern North America in situations suggesting utilization and perhaps even cultivation. Chenopodium was recovered from 11 contexts and has a Ubiquity Score of 23 percent. None of the recovered Chenopodium specimens were charred.

b. *Amaranthus*

Like Chenopodium, Amaranthus (*Amaranthus* spp.) or pigweed has been recovered in archaeological contexts in eastern North America in situations suggesting utilization and perhaps even cultivation. Gilmore (1931) examined quantities of dry-preserved material from rock-shelters in southwestern Missouri and northwestern Arkansas and identified corn, squash, and seeds of sunflower, chenopods, marsh elder, canary grass, giant ragweed, and amaranth, all in situations suggesting that they had been stored.

Despite this finding, the use of Amaranthus (pigweed) by aboriginal peoples is still not fully understood. Peterson and Munson (1984:317-337) present a comprehensive explanation and summary of the problems surrounding the inclusion of pigweed as a prehistorically utilized food. There are numerous questions associated with the identification, productivity, availability, and usage of Pigweed. There are some 60 species of Amaranthus, and it is difficult to distinguish between them utilizing only the seed. Nor can pollen analysis differentiate amaranth pollen to the species level. Further, it is not possible to distinguish the family Amaranthaceae from *Chenopodiaceae* (except with an electron microscope). There is debate as to whether all species are native to America (Tucker and Sauer 1958:259-60). There is also disagreement as to the economic attractiveness of amaranth to aboriginal gatherers/cultivators. Uncharred seeds were recovered from two context giving Amaranthus a Ubiquity Score of 4 percent.

c. *Knotweed /Smartweed*

There are about 150 species of *Polygonum* which occur in the United States alone (Hatch 1980:207). Knotweeds are members of the buckwheat family and are liabilities as weeds, but they provide a valuable source of wildlife food (Martin 1972:40). Knotweeds *(Polygonum punctatum)* are sometimes called smartweeds because they contain an acrid juice which can sting the skin. They are partial to moist soil, cultivated fields, and ditches. Knotweed *(Polygonum erectum)* is thought to have been a possible minor cultigen. Knotweed seeds are commonly found in flotation samples from contexts as early as 500 AD (Cowan 1985:217).

Polygonum punctatum is also called water smartweed and favors waterlogged ground (Hatch 1980:208). There are numerous ethnographic references to the medicinal use of water smartweed. In *Virginia Indians* it is stated that the juice of the leaves was used for dressing wounds (Erichsen-Brown 1979:218-219). The Meskwaki, Potawatomi, and Ojibwe made a tea from the leaves and stems (Erichsen-Brown 1979:218-219).

Knotweed *(Polygonum erectum)* seeds are the most commonly encountered seed in flotation samples from sites in the lower Illinois River Valley (Cowan 1985:217). Few seeds have been found in pre-Middle Woodland archaeobotanical assemblages (Asch and Asch 1985:183), and investigators are puzzled as to why Knotweed is not present in Archaic contexts. Asch and Asch (1985:186) point out that Archaic sites such as Koster bear evidence of occupations as intensive and nearly as sedentary as those of Woodland times. If Woodland habitation sites were abundant with Knotweed, so too should have been some Archaic habitations. Evidence of Archaic harvesting of Iva and Ragweed indicated some interest in utilizing small edible seeds (Asch and Asch 1982), and it is unlikely that knotweed would have been overlooked for exploitation (Asch and Asch 1985:186). The hypothesis of knotweed cultivation is consistent with evidence concerning its prehistoric economic status and with information about its modern natural distribution and abundance. However, the differences between the Archaic and Woodland period archaeobotanical recovery are the subject of continued study (Asch and Asch 1985:1860). Uncharred Knotweed was recovered from two samples and has a Ubiquity Score of 4 percent.

d *Pokeweed*

Pokeweed *(Phytolacca americana)* is a native perennial whose young shoots can be cooked as greens. The root, the mature plant, and the seeds are poisonous. The Pamunky Indians of Virginia used a tea made by boiling the berries (Cox 1985:242). The Mohegan of Connecticut mashed the berries to make a poultice. They also used the juice from the berries to make a dark blue stain (Tantaquidgeon 1977:75). Pokeweed is a common weed found in pastures, fields, and waste places. Two uncharred seeds were recovered. Pokeweed was recovered from three samples and has a Ubiquity Score of 6 percent.

e. *Sedge*

Sedge *(Cyperaceae spp.)* is a grasslike or rushlike herb with fibrous roots. Sedge is a large widely dispersed family found in damp sandy soil (Peterson 1977:230). Small nutlike tubers radiate from the base of the plant. The tuber can be cooked, ground into flour, or used in beverages. Uncharred sedge was identified in 13 samples and has a Ubiquity Score of 27 percent.

f. *Chufa*

Chufa *(Cyperus esculentus)* is a grasslike tuber belonging to the sedge family. The culms or stems grow from one to three feet tall (Medsger 1966:171). It is found in damp sandy soil. Slender, scaly runners terminated by small nutlike tubers radiate from the base of the plant. The tubers, which are edible, are sweet and have a nutty flavor. The tubers can be eaten raw, cooked, or ground into a flour (Peterson 1977:230). The most important aspect of assessing the chufa in a prehistoric diet is that it was available all year long. Uncharred chufa was recovered from two contexts and has a Ubiquity Score of 4 percent.

g. *Flatsedge*

Flatsedge *(Cyperus* spp.) is a low to medium-height, erect, grasslike herbaceous plant which grows eight to 40 inches tall (Tiner 1987:177). Its habitat is inland marshes, swamps, and wet shores (Tiner 1987:177). Flatsedge is similar to Chufa in that it has a tuberous rhizome. It is likely that it was utilized in the same manner as Chufa. Uncharred flatsedge specimens were recovered from 26 samples, giving it a Ubiquity Score of 54 percent.

h. *Grass*

All grasses (*Graminae* spp.) have stems with solid joints and two-ranked leaves, one at each joint. Grasses have a wider range than any other plant family and can endure extreme environmental conditions (Chase 1948:8-15). Uncharred grass seed was recovered from 34 contexts and has a Ubiquity index of 71 percent.

i. *Spurge*

Spurge *(Euphorbia* spp.) is a native perennial (Cox 1985:206). As a food source, the seeds are important to several species of game and song birds. There are about 36 species in North America. Flowering spurge is found in old fields, pastures, waste areas, along roadsides, and in open woods. In herbology several species are recommended for the initiation of vomiting and as purgatives. However, the milky juice of these plants contains toxic compounds. The sap may cause blistering and inflammation of the skin in sensitive individuals.

There is extensive documentation that the ground leaves and flowers of spurge were used for snake bites by the Navaho, Shoshone, and Pima; as a urinary aid by the Cherokee; as a lip balm by the Hopi; and as a worm expellant by the Fox (Moerman 1986:184-187). The roots were used as a cathartic by the Meskwaki and the Ojibwa (King 1984:111). A total of two contexts contained uncharred spurge seeds. The Ubiquity Score is 4 percent.

j. *Blackberry*

Blackberry *(Rubus* spp.) bushes grow from three to nine feet high. The blackberry is one of the most valuable wild fruits. It grows in some form over almost the entire eastern United States (Medsger 1966:29). Shrub communities are fast to colonize newly opened forest. Shrub communities with a high proportion of fruit bearers would be expected in intermediate stages of succession of lowland forests. Not only were the fruits eaten but also a bark tea was made by the Potawatomi and Ojibwa for coughs and colds (King 1984:154).

Various species of *Rubus* were stored by Native American groups for use during the winter months

(Keene 1981:80). The Iroquois used the dry fruit as a cooking condiment and as a trail food. The effort involved in preparing fruit for storage would have been minimal. Rogers (1973:69) reports that the Cree dried berries by boiling them down, spreading the mixture on bark trays, and setting the tray in the sun. This produced a flat cake which could be sliced and eaten. Waugh (1973:127) notes that the Iroquois dried berries both in the sun and on racks spread over fires. Uncharred blackberry seeds were recovered from two contexts. The Ubiquity Score is 4 percent.

k. *Deerberry*

Deerberry (*Vaccinium* spp.) include some 15 or 20 species comprising the blueberry family in the United States. The exact species are often difficult to determined, but none of them is poisonous (Medsger 1966:71). Deerbeery or squaw huckleberry has fruit that is round or slightly pear shaped, sometimes half an inch in diameter, and is sour and not good to eat raw. When cooked, they are considered quite good. Uncharred deerberry was recovered from two samples and has a Ubiquity Score of 4 percent.

l. *Paspalum*

Paspalum (*Paspalum* spp.) is a genus of approximately 200 species. Paspalums are perennial or annual grasses that range in height from a few inches to more than four feet (Martin 1972:21). Uncharred paspalum was recovered from three contexts and has a Ubiquity Score of 6 percent.

m. *Doveweed*

Doveweed (*Croton* spp.) is a genus of about 600 species with about a dozen occurring in the United States (Martin 1972:78). Doveweeds belong to the Spurge family. Some species are low-growing and compact, and others grow tall and openly branched. Gamebirds favor the seeds. Uncharred seeds were recovered from four samples; the Ubiquity Score was 8 percent.

n. *Cress*

Marsh Yellow Cress (*Rorippa islandica*) is an annual with a thick taproot. This is a genus of about 40 species with worldwide distribution. There are eight species in the Northeast, four of which are native to North America. Most species occur in moist to wet substrates. *R. Islandica* is highly variable, with several varieties based on leaf characteristics. Marsh Yellow Cress has edible greens (Cox 1985). Uncharred cress was identified in two samples and has a Ubiquity Score of 4 percent.

o. *Chokecherry*

Chokecherry (*Pyrus* spp.) is a common shrub found in wet to dry thickets and swamps. Chokecherries are edible and produce fruit from August until October (Peterson 1977:220). Uncharred chokecherry was recovered from two contexts and has a Ubiquity Score of 4 percent.

p. *Dodder*

Dodder (*Cuscuta gronovii*) is an annual parasite with root-like structures that penetrate the conductive system of a host plant. Seeds germinate in the soil and the seedlings soon come into contact with host plants. Contact with the soil is then broken, and they become totally dependent on the hosts. The 12 native and 3 introduced species of this genus in the Northeast are very similar and distinguished from one another on rather technical characteristics. Dodders have been declared noxious weeds in the seed laws of 42 states and by the Federal Seed Act (Cox 1985:304). *Cuscuta gronovii* is the most common species of dodders and is found on a great variety of host plants in wet areas. Uncharred dodder was found in only one sample and has a Ubiquity Score of 2 percent.

4. *Charred Specimens*

Charcoal is the charred remains of a plant's woody structures and is predominantly from trees and shrubs. Wood and charcoal fragments are not direct elements of the diet but can be a floral artifact resultant of cultural mechanisms. Small charcoal flecks were observed in 35 of the 50 flotation samples studied. The flecks were too small to extract or weigh. Larger charcoal fragments were recovered from excavation. A total of 18 charred wood fragments were recovered from excavation and had total weight of 28.4 gm.

Burning does not ensure wood preservation. Some wood can burn completely, leaving ash rather than charcoal. Charred wood is resistant to decay and therefore preserves well. Charcoal is commonly found in prehistoric contexts (Carbone and Keel 1985), and large concentrations can suggest the presence of a hearth or fires. Wood, of course, was burned as fuel for fires. Yarnell (1964:27; 1965) discussed the effects of selective firewood-gathering and differential self-pruning of various trees.

Charcoal flecks were present in 73 percent of the samples; however, only 15 charred seed specimens were recovered from the flotation samples. Woodbine, sumac, and sumpweed were recovered in the charred state from the flotation samples. During excavation, three unidentified charred nutshell fragments, one charred hickory nutshell fragment, one charred cherry pit, and one charred sumac seed were recovered.

a. *Woodbine (Root: Medicinal Herb)*

Woodbine (*Parthenocissus quinquefolia*) is also commonly called Virginia Creeper (Fernald 1970:995). Woodbine is commonly found in woods and thickets and flourishes between June and August. A single charred woodbine specimen was recovered from Feature 23 in Unit 21. Uncharred woodbine was also recovered from two non-feature contexts in Unit 21. Woodbine has a Ubiquity Score of 6 percent.

There is no documentation that Woodbine was utilized prehistorically as a foodstuff. However there is documentation that Woodbine was used medicinally by the Cherokee as an infusion for jaundice (Moerman 1986:325). Woodbine was used by the Fox to cure diarrhea. The Iroquois used Woodbine in poultices, compounds, and decoctions for swellings and wounds and to counteract poison sumac (Moerman 1986:325).

b. *Sumac (Leaves, Root-Smoking Material, Dye, Medicine, and Basket Making; Fruit-Beverage)*

Sumac (*Rhus* spp.) is a small tree or shrub with dense clusters of small fruit. Poison Sumac is easily distinguished from other varieties of sumac because the poisonous berries are white and all others are red (Medsger 1966:214). There is extensive documentation of the medicinal utilization of numerous species of Sumac by the Navaho, Ojibwa, Delaware, Chippewa, Fox, Pawnee, Ponca, Iroquois, and Potawatomi. The uses ranged from elimination of worms to healing snakebites and sores (King 1984:74; Vogel 1970:376). The fruit, when soaked in water, makes a delicious beverage (Peterson 1977:186). The beverage has been dubbed "Indian lemonade" (Medsger 1966:213).

Sumac leaves and roots were used to make a ceremonial tobacco mixture, and the split stems were used in basket making (Moerman 1986:402-407). According to a historical dictionary of 1813 (as quoted in Kavasch 1979:165), Sumac berries became so esteemed in Europe for smoking that they were preferred to the best of the cured Virginia tobacco. It was reported by an early writer in 1779 that:

> An Indian carries pouch and pipe with him wherever he goes, for they are indispensable. For state occasions they may have an otter skin pouch or a beaver-pouch . . . In the pouches they carry tobacco, fire material, knife and pipe. Sumac is generally mixed with tobacco or sumac smoked without tobacco [as quoted in Erichsen-Brown 1979:115].

It is further reported in 1778 that:

> Sumac likewise grows here in great plenty; the leaf of which, gathered . . . when it turns red, is much esteemed by the native. They mix about an equal quantity of it with their tobacco, which causes it to smoke pleasantly [Carver 1778:30 as quoted in Erichsen-Brown 1979:115].

Byrne and Finlayson (1974) report that staghorn sumac made up 15.6 percent of the wild plant seeds found at the Crawford Lake Site in Ontario. They were found in 39.3 percent of the examined features, pits, ovens, and middens. They were the only seeds identified to species (Erichsen-Brown 1979:115). At the Draper Site in Ontario, sumac seeds archaeologically represented the fourth largest amount of all seeds recovered (Erichsen-Brown 1979:115).

A report written by Harriot in 1590 entitled *Virginia Indians* says about sumac:

> Dyes of divers kindes. There is Shoemake well knowen, and used in England for blacke. . . The inhabitants use them only for the dyeing of hayre; and colouring of their faces, and Mantles made of Deare skinnes; and also for the dying of ushes to make artificial workes withal in their Mattes and Baskettes" [as quoted in Erichsen-Brown 1979:115].

Sumac fruits from August through October. The leafstalks and roots would be available all year.

A single charred sumac seed was recovered from Feature 18 in Unit 28; this single recovery gave sumac a Ubiquity Score of 2 percent. One additional charred sumac seed was recovered during excavation from Feature 26 in Unit 29.

c. *Sumpweed (Kernels: Food)*

Sumpweed (*Iva annua*) is an oily-seeded annual whose appearance is similar to a tiny sunflower seed. Technically the seed is called an achene and it consists of a kernel (the true seed) attached at one place to a thin dry shell which is called the pericarp. Sumpweed achenes have been found in numerous prehistoric contexts which has led investigators to believe that it was an important native seed singled out for extensive exploitation. Asch and Asch (1978, 1985) have done extensive research on sumpweed and present persuasive arguments concerning its economically significant attributes which will be summarized here.

Sumpweed seeds are a concentrated source of food energy because of their high fat and low moisture content. On a per gram basis, they provide an equivalent number of calories as sunflower kernels and more than Chenopodium and acorns. Sumpweed is also an excellent source of vitamins, minerals, crude fiber, and protein.

Asch and Asch (1985:302) point out that unprocessed achenes are unpalatable because of an objectionable odor and taste of the shell and because the tough, fibrous, indigestible shell makes up about 45 percent of the total achene weight. They experimented with roasting and boiling the achenes and found that these methods of processing eliminated the objectionable odor and flavor (Asch and Asch 1985:302-303). The separation method that Asch and Asch found successful was as follows: (1) boiling the achenes for several minutes, which causes many shells to split open partially and weakens the rest; (2) drying the boiled achenes to reharden the kernels; (3) rubbing the material between the hands to separate kernels from shells; and (4) winnowing the shells. None of the seed fragments from Site 7S-F-68 exhibit attached pericarps. The absence of pericarp residue suggests that pericarp removal occurred prior to parching or at the location of exploitation, rather than as a result of inadvertent thermal degradation.

Habitats of sumpweed include a variety of wetland settings: alluvial soils along streams, borders of ponds and sloughs, river bottoms, meadows, low fields in valleys, and areas which are flooded in the spring and often wet throughout the growing season. Sumpweed grows where there is a cover of short grasses but it is less successful where it competes with other weeds and tall grasses. Sumpweed is an edge species occurring between permanently wet and somewhat better drained soils. Sumpweed commonly occurs in dense stands in which it is the tallest plant. The seasonal growth pattern is such that germination occurs during April culminating in flowering at the end of August. Achenes are ripe and ready to drop around October. The effective harvest season for sumpweed is probably no more than two weeks. Figure 38 provides an illustration of sumpweed.

Asch and Asch (1978) did extensive experimentation on harvesting procedures and yields. The return for one hour of harvesting meets an adult's daily energy requirement. They estimated that during the two-week harvest season a 120-day total energy supply could be obtained. From the viewpoint of energetics it is feasible to harvest dense stands of wild sumpweed with yields similar to other wild plants that were taken into cultivation as dietary staples.

Asch and Asch (1978) suggests that after prehistoric gathering of wild sumpweed began some achenes undoubtedly were lost at campsites, resulting in volunteer plants. However, they assert that it seems unlikely that the beginnings of sumpweed cultivation can be accounted for as a gradual shift from a gathered plant to a "weedy camp follower" to a "door garden" or "dump heap" cultigen. Sumpweed is more appropriate as a field crop than as a small crop in a garden. Other early eastern North American cultigens are different in this respect.

The major value of sumpweed was presumably as a storable source of food energy. Its economic potential depends on its attractiveness in relation to competing species, on the overall demand for food, on the organization of the settlement system, and on other cultural variables. Asch and Asch (1985) compared the collection of sumpweed with the collection of acorns and hickories because they believe that these nuts were the major pre-agricultural source of plant-derived food energy in eastern North America. They explain that hickory nuts are seasonally available before sumpweed. Therefore the need to collect sumpweed may depend on the success of the nut harvest. They suggest that it is unlikely that collectors would forego harvesting nuts in the expectation of collecting sumpweed.

Sumpweed was recovered only in the charred state. A total of 13 sumpweed seeds were recovered from the site area. The Ubiquity Score was 8 percent. Two were recovered from Feature 26 in Unit 29; seven were recovered from Feature 20 in Unit 47; three were identified in Feature 17 in Unit 25; and one was recovered from Feature 19 in Unit 38. Sumpweed was present in contexts dating to 2460 ± 130 years BP (Feature 19), 1020 ± 70 years BP (Feature 17), and 310 ± 80 years BP (Feature 20).

Archaeobotanical documentation of gradual increase in sumpweed achene dimensions provides evidence of a domestication of the plant in eastern North America (Asch and Asch 1978; Yarnell 1978). Asch and Asch (1978) have compiled data on sumpweed measurements from archaeological contexts and have compared those measurements to modern achene size. Modern sumpweed achenes measured from a variety of wild populations in the lower Illinois Valley rarely exceeded 3.0 mm in length. To estimate original sumpweed achene dimensions from a carbonized sample, a common procedure is first to add 0.7 mm and 0.4 mm, respectively, to the observed length and width if the specimen is a naked kernel, and then to make a correction for 10 percent shrinkage due to

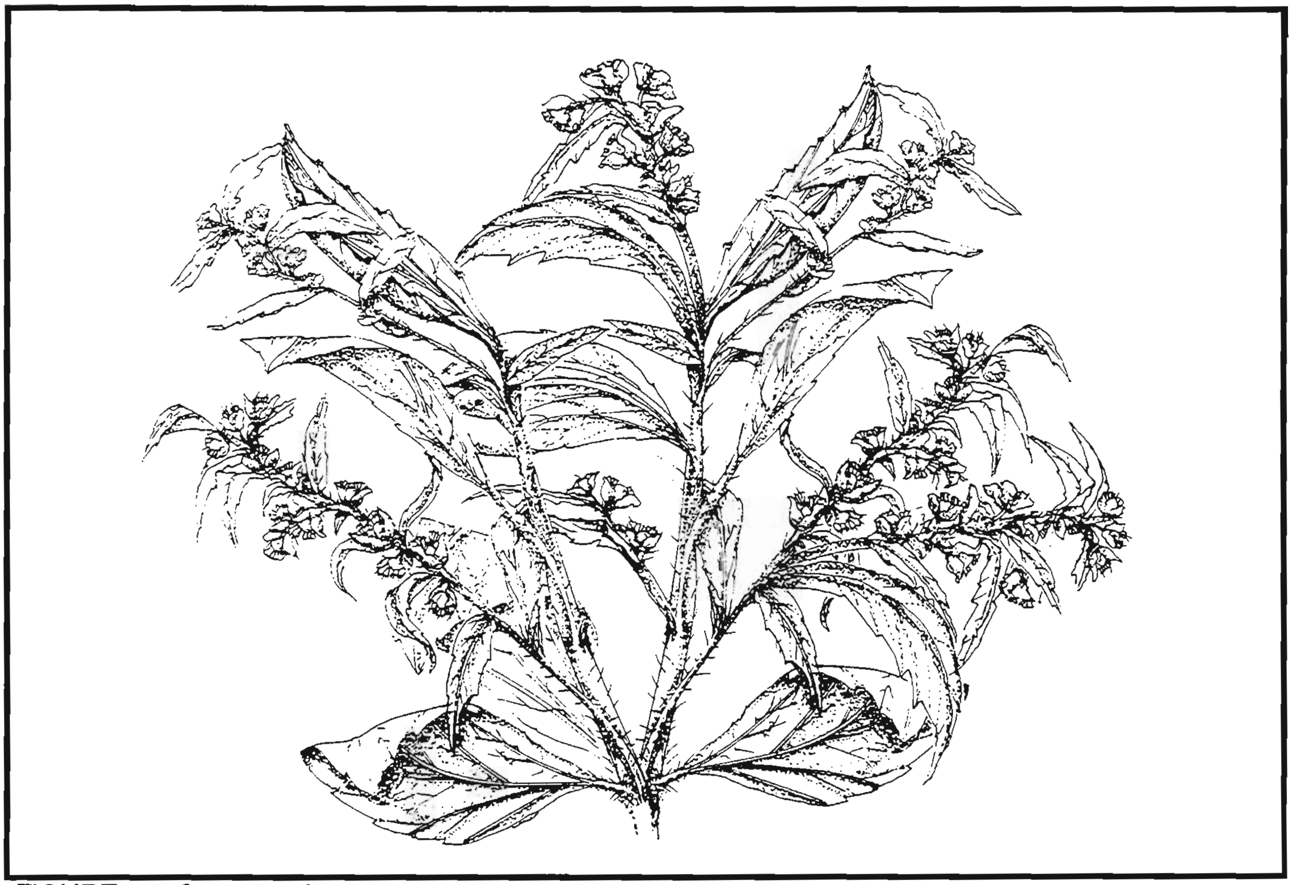


FIGURE 38: Sumpweed.

carbonization (Yarnell 1972:336-337). Asch and Asch compared modern lengths to specimens collected from prehistoric contexts and found that the smallest prehistoric achenes were larger than the mean size from any wild stands they had observed.

Table 25 lists the dimensions for the nine whole charred sumpweed specimens recovered from the site. Using Yarnell's procedure to estimate seed size, the mean length is 5.3 mm and the mean width is 3.2 mm. These values are comparable to those observed at Middle to Early Late Woodland sites in Illinois, Kentucky, and Mississippi (Yarnell 1978:295). Although Site 7S-F-68 has provided only a small sample from which to estimate a change in achene dimensions, the recovered data do suggest that the seeds are more comparable to prehistorically utilized achene assemblages than to modern achene samples from noncultural contexts.

d. *Hickory (Nuts: Food; Shell: Fire Enhancer)*

Hickory (*Carya spp.*) was also represented within the site area. Hickory trees grow best in well-drained soils and well-drained hillsides. Hickory bears consistently; however, yearly yields vary, with a good crop expected at least once every three years (Keene 1981:66). Hickory is an important wildlife food for which there is great competition from animals. Squirrels, for example, tend to remove the unripened green nuts from the trees. However, hickory is not subject to the extensive damage or production of immature seed observed in acorns (Keene 1981:66). Hickory nuts generally are at their peak in October.

Hickory nutshells seem to be the one item remaining from food preparation that is consistently burned. Apparently Indians in eastern North America discovered that Hickory shells make an excellent, hot, virtually smokeless fire for cooking (Smith 1985:121). The proportion of Hickory shell far outweighs other shell types in prehistoric sites of the East. The occurrence of Walnut shell in eastern prehistoric sites is much more sporadic and less consistent. A charred fragment of Hickory nutshell weighing 1.3 grams was recovered from Unit 15, Strata B, Level 2.

Ethnographic accounts dating from the contact period are useful in determining how people may have prepared these nuts. According to early travelers, Indians collected hickory nuts mainly for their oil, although they also ate the nut meats (Swanton 1946:364). An early historian described how the oil was extracted:

> At the fall of the leaf, they gather a number of hiccory-nuts, which they pound with a round stone, thick and hollowed for the purpose. When they are beat fine enough, they mix them with cold water, in a clay bason, where the shells subside. The other part is an oily, tough, thick white substance, called by the traders hiccory milk, and by the Indians the flesh, or fat of hiccory-nuts, with which they eat their bread [Adair 1775:408, quoted in Swanton 1946:365].

Three charred nutshell fragments which could not be identified to species were also recovered from excavation.

e. *Cherry (Berry: Food; Bark: Medicine)*

A single charred cherry pit fragment was recovered from Unit 45, Stratum B, Level 6. Cherry (*Prunus* spp.) trees prefer rich moist soils but will also grow well in sandy soils. Cherry trees are shade intolerant and would not be expected in significant numbers within mature forests. Cherry saplings may often compose a large proportion of the understory trees in xeric and mesic forests but their densities decrease as the stands age and the forest canopy develops (Keene 1981:81). Cherry trees are likely to grow along riverbanks or in relatively open areas.

Cherry fruit was extensively exploited in prehistoric and historic times in the eastern United States and is well documented (Yarnell 1964:62). The wild cherry produces a small fruit that is available between August and September. The trees are relatively consistent producers, generally bearing some fruit every year (Keene 1981:81). Cherries are subject to heavy animal predation both in the trees and after they have dropped. Keene (1981) suggests that as much as 80 percent of the crop is lost to wildlife and insects. Cherries would be more costly in terms of time expended to harvest than other plant foods. The trees grow to substantial heights, and the fruit is often located on upper limbs. The fruit grows in clusters but is not easily shaken loose. Beyond collection, processing costs would have been minimal because the fruit can be eaten raw or dried for later use (Keene 1981:82).

The bark of the cherry tree was also used medicinally by historical Native American populations. A warm infusion of the bark was given to Cherokee women in the first pains of childbirth. The Ojibwas used the inner bark of cherry, boiled, bruised, or chewed as an application to external sores (Vogel 1970:388-389).

5. *Seasonality*

The recovered charred floral specimens exhibit a definite pattern of seasonality, suggesting use of the site during the autumn months. Hickory nuts are at their peak at the end of September and beginning of October. Sumac fruits between August and October, although the root and stemstalk would be available all year. Cherry trees produce fruit in the early fall, from the end of August through September. Sumpweed achenes ripen around the middle of October. Ordinarily, some hickory nuts will still be available but in declining abundance when sumpweed is ready to harvest. Woodbine, which is in profusion from June through August, is the only one of the analytically significant botanicals recovered that deviates from the pattern of autumn procurement.

Table 25: Metrics for Recovered Sumpweed Specimens

CONTEXT/DATE	LENGTH	WIDTH	ESTIMATED LENGTH	ESTIMATED WIDTH
Feature 17	4.2	2.7	5.2	3.2
1020 ± 70 years BP	4.3	2.7	5.3	3.2
(Beta-56043)	4.0	2.6	5.1	3.1
Feature 19	5.0	3.1	6.1	3.7
2460 ± 130 years BP				
(Beta-56045)				
Feature 20	5.0	2.8	6.1	3.3
310 ± 80 years BP	4.1	2.6	5.1	3.1
(Beta-56048)	4.0	2.5	5.0	3.0
Feature 26	4.0	2.7	5.1	3.2
Late AU	4.1	2.6	5.1	3.1
MEAN	4.3	2.7	5.3	3.2

All measurements expressed in millimeters; estimates derived according to procedure given by Yarnell (1972:336-337).

E. FAUNAL ANALYSIS

A total of 192 bone fragments with a combined weight of 98.9 grams was recovered from the site area. Three-fourths of the faunal assemblage was nondiagnostic bone fragmentation. These nondiagnostic fragments were categorized as "Mammal/Bird" because it could not be determined whether the bone fragments were derived from mammal or bird. Four percent of the assemblage was identified as Mammal/Bird longbone fragmentation. Nineteen percent of the assemblage could be identified as bird bone and 2 percent of the assemblage could be identified as mammal bone.

Fifty-five percent of the recovered faunal assemblage was charred. A total of 105 specimens were charred to the white state, and 1 was charred black. The color pattern of the burned specimens at this site exhibited a homogeneity that does not suggest a pattern of successive fires. Hearth areas utilized for long periods of time would be more likely to exhibit a mix of charred bone colors, ranging from blacks, to grays, to whites. Hearth areas are normally raked or cleaned; and if the hearths were intensively used, they should receive discarded bone. Bone waste would likely show a diversified charred color pattern as a result of these activities. Based on the bone waste, it is suggested that the hearths at this site were not utilized for prolonged periods of time.

1. *Mammal*

Only three specimens could be positively identified as mammal. One mammal tooth enamel fragment was recovered from Unit 15, Stratum B, Level 2. One small fragment (2.3 cm long) of longbone was recovered from the plowzone of Unit 21. One tarsal/carpal fragment from a small mammal was recovered from Unit 34, Stratum B, Level 3.

2. *Bird*

A total of 37 specimens were identified as bird. A scapula fragment was recovered from Unit 42, Stratum B, Level 2. A phalanx was recovered from Unit 36, Stratum B, Level 2; 1 phalanx fragment was recovered from Unit 35, Stratum B, Level 5; and 3 phalanx fragments were recovered from Unit 36, Stratum B, Level 2. A digit was recovered from Unit 36, Stratum B, Level 2. A total of 30 longbone fragments ranging in length from 0.1 to 2 cm were recovered from various units throughout the site. The size of the unidentified bird fragments suggests that they were from small birds rather than large waterfowl. Two small birds which would have been locally available and abundant are pigeons and quail. While the recovered bird fragments could not be positively identified to these species, it is assumed that some of the bird fragmentation may be representative of these species, given the documented importance of these species in the prehistoric diet.

There is extensive ethnographic documentation regarding utilization and collection methods for pigeon. A good description of the gathering of passenger pigeons to nest along the Genesee River in New York in 1782 is described by Horatio Jones who lived among the Seneca:

> Word of the annual nesting of pigeons was spread though out the Seneca territory. The Indians gathered in the locality of the pigeon woods. The Indians cut down the roosting trees to secure the birds and each day thousands were killed. Fires were made and dressed birds were suspended to dry in the heat and smoke. When properly cured they were packed in bags or baskets to the home towns [Harris 1903:450].

Pigeons were also taken by the Iroquois in the 1600s. Instances have been reported of more than 1,500 being taken at one time with the aid of nets are known (Keene 1981:114). The Delaware are known to have hunted pigeons by chopping down the trees in which the pigeons roosted, many of the pigeons being killed when the tree toppled (Keene 1981:114).

Mass migrations of pigeons usually appeared in northern states as soon as the ground was bare of snow. Pigeons were colonial animals and remained together during the spring and fall roost. It has been reported that the densities of pigeons in these roosting places was so great that trees were toppled from the sheer weight of the pigeons sitting in them (Keene 1981:112-113).

Squabs were the preferred take. Approximately two weeks after hatching, the young were abandoned by the adults. At this time the squab was apparently a mass of fat and equaled, or exceeded, the weight of the adult. Within three to four days, it could fly well enough to escape capture (Keene 1981:112). Pigeons were eaten fresh, smoked, or dried by Native American populations, but were particularly favored for their fat and were frequently boiled down to recover the fat (Keene 1981:114).

North American quails include the bobwhite. The quail (*Colinus virginianus*) was named after its Old World counterpart. When the first Europeans came upon a New World bird for which they had no name, they called it after the Old World bird they thought it most resembled. In Virginia this was felt to be the partridge, in New England the quail. The first name remained localized, the second was applied throughout the United States (Root 1980:390). Bobwhite Quail have large, white fleshed muscles which permit rapid flight, but in brief spurts only. They lack the rich blood supply necessary for sustained flight.

F. CONCLUSION

The recovered faunal specimens were highly fragmented and lacking in diagnostic properties. The paucity of identifiable faunal material precludes interpretation of animal food utilization in the site area, although the data suggest that small birds the size of pigeon and quail may have been exploited at the site area.

Only 16 seeds, one fruit pit, three unidentified nutshell fragments, and one fragment of hickory nutshell were recovered in the charred state. These charred specimens represented five native plant types. Although only a small amount of analytically significant floral material was recovered from this site, the floral assemblage has important interpretive value. There is documented ethnographic usage of both woodbine as a medicinal herb and sumac as a dye, medicinal herb, for cordage and as a smoking material. There is documented usage of cherry both for food and as a medicinal, and hickory nuts were used as food and as a fuel for hot, smokeless fires. The distribution of the analytically significant floral assemblage according to analytical units is given in Table 26.

The charred sumpweed *(Iva annua)* was the most significant botanical material recovered from the site. Sumpweed is an indigenous annual seed plant which played a prominent role in eastern North America in the transition from the sole dependence of humans on the hunting and gathering of wild plants to cultivation. The question of why populations in eastern North America abandoned an economic pattern of hunting and gathering that had sustained them for almost 7,000 years remains unanswered (Cowan 1985:206). It is likely that changes in subsistence systems more often involve shifts in emphasis than conscious species replacement. Foragers possess extensive knowledge of the productive capabilities of plants and actively employ this knowledge to manipulate the life cycles of plants to improve their reproductive capacities (Cowan 1985:222). Cowan (1985:222-224) discusses burning, irrigation, intentional propagation, and ritual as methods by which hunters and gatherers actively sought to increase or maintain the productivity of their environment.

Asch and Asch (1985:334) have addressed the question as to why sumpweed fell into disuse. They suggest that perhaps it was never regarded as a primary food source, since it had reached a plateau of utilization prior to the establishment of maize as the staple cultigen and even before the native complex of starch seeds became well established. The Late Woodland decline in nut utilization may be indicative of a general reduction in dependence on oil seeds relative to starchy seeds. The uses of sunflower are most similar to sumpweed and it would have competed most directly with sumpweed as a food source. Yarnell (1972) suggests that as sunflower developed domesticated characteristics such as large achenes and a single large disk, it may have replaced sumpweed because it became a superior cultigen. Further, the development of a polycultural crop system in eastern North America may also have played a part in the declining use of sumpweed.

The recovery of a mano and metate at this site raised the question as to what plant food or foods were being processed with these tools. The results of the flotation analysis suggest that sumpweed was the primary resource being processed at this procurement site. It is also important to note that other important starchy grains were recovered from the site area. Chenopodium, Amaranthus, and knotweed were all present within the studied samples. Although they were not recovered in the charred state and thus are not considered prehistoric in origin, it is possible that they were present during the prehistoric utilization of the site area. Considering the total sample of recovered botanicals, charred and uncharred, there was a diverse assemblage of starchy grains, herbs, nuts, and fruits available in the site area which could have been exploited by a prehistoric population.

TABLE 26: DISTRIBUTION OF CHARRED NATIVE SPECIMENS IN ANALYTICAL UNITS

ANALYTICAL UNIT	FLORAL SPECIMENS
Early (Paleoindian and Early Archaic)	Cherry (*Prunus* spp.) Sumac (*Rhus* spp.)
Middle (Late Archaic/Early Woodland)	Sumac (*Rhus* spp.) Sumpweed (*Iva annua*) Woodbine (*Parthenocissus quinquefolia*)
Late (Late Woodland)	Sumpweed (*Iva annua*)

IX

SYNTHESIS AND CONCLUSION

This chapter synthesizes the results of the data recovery program with specific reference to the project research design (Chapter IV). The research design explicitly proposed addressing themes of chronology, subsistence, settlement patterns, intrasite patterning, environmental adaptation, and technology, and there is much interrelation among these issues. To a greater or lesser extent, these research themes correspond to and crosscut a number of recommended research topics in the Delaware State Plan for Management of Prehistoric Resources (Custer 1986a). Where possible, the research findings are discussed with reference to the state plan as well as general models of prehistoric cultures in the surrounding Middle Atlantic region.

A. CHRONOLOGY

The excavations at Site 7S-F-68 have produced evidence that the site was used as early as the Paleoindian period and throughout the Archaic and Woodland periods. This study has employed the traditional divisions of the major cultural periods that are used across the Eastern Woodlands, in contrast to the framework developed for Delaware by Custer (1984, 1986b), which expands upon work by Gardner (1974, 1977). For example, in Custer's (1984) system, Early Archaic point types, such as Palmers and Kirks, are considered to be part of the Paleoindian period; and the Late Archaic, Early Woodland, and Middle Woodland periods are combined into a unit called "Woodland I." In the traditional Eastern Woodlands chronology, the Archaic period spans a period of seven millenia, roughly from 8,000 BC to 1000 BC, while it is reduced to a much shorter period of time in Custer's system, roughly 6500 to 3000 BC.

The earliest occupation of Site 7S-F-68, a Paleoindian component, is best represented by a quartz crystal late-stage biface that appears to be a fluted-point production failure The fluted-point production failure was associated with a small assemblage of crystal quartz debitage and tools. Relatively little is known of Paleoindian occupation of the Delmarva Peninsula, and there was insufficient evidence at Site 7S-F-68 to describe a Paleoindian component. What is perhaps most remarkable at Site 7S-F-68 is the use of crystal quartz as a raw material, and it is notable that all of the fluted points from the Higgins Site in Anne Arundel County, Maryland, were manufactured from quartz (Ebright 1992).

In the Middle Atlantic region, there is a pressing need for basic information pertaining to the Archaic period chronology (cf. Wesler 1983). Although the excavations at Site 7S-F-68 did not produce a clearcut stratigraphic sequence or new radiocarbon dates for some of the poorly dated projectile point types that are widely distributed throughout the region, the recovery of a large sample of culturally diagnostic artifacts from the site permitted reconstruction of a site-specific chronology that may be compared to the regional chronological sequence.

The site chronology spans the entire Archaic period, with two intervals of intensive site occupation. The initial period of intensive occupation occurred during the Early Archaic, represented by various Palmer, Kirk, Decatur, and bifurcate-based points. Radiocarbon dates for these points suggest that the initial occupations occurred between circa 7800 and 5300 BC (Gleach 1987), and the earliest radiocarbon date for Site 7S-F-68 falls in this interval (7560 $\pm$ 340 years BP; Beta-56049). The second interval of intensive occupation spans the Late Archaic/Early Woodland period and is represented by a cluster of stemmed points. These points represent a variety of point types, many of which are widely distributed throughout the region but are not securely dated. Two of the radiocarbon dates from the site fall into this period of intensive site occupation (2640 $\pm$ 110 years BP [Beta-56051] and 246 $\pm$ 130 years BP [Beta-56045]).

There is very limited evidence of site use during the period from circa 5300 BC to 4000 BC, an interval which falls in the Middle Archaic period. One rhyolite point with broad side notches and a heavily ground base was identified as an Otter Creek point, which is considered to be a Middle Archaic diagnostic (Ebright 1992). Primarily because of a scarcity of radiocarbon dates and stratigraphic evidence, there is disagreement among archaeologists regarding the Archaic period chronology in the Middle Atlantic region. In particular, the division between the Early Archaic and Middle Archaic periods is in dispute.

Some archaeologists, including Gardner and his students, see a cultural discontinuity between the corner-notched point phases and the bifurcate-based point phases, placing the latter in the Middle Archaic and setting a terminal date of circa 6500 BC for the Early Archaic (Custer 1990; Gardner 1987; Stewart 1990).

Others place the bifurcate phase in the Early Archaic, as is more commonly done in the Southeast, and bracket the Middle Archaic to the interval from circa 6000 BC to 4000 BC (Steponaitis 1980; Wanser 1982; Wesler 1983). While there are significant differences in technology between the bifurcate-based points and the Palmer and Kirk points, published radiocarbon dates and stratigraphic evidence indicate that there is considerable temporal overlap among these points. Therefore, the bifurcate-based points are included with the Palmer and Kirk points in the Early Archaic component at Site 7S-F-68.

Archaeologists in the Eastern Woodlands culture area have traditionally divided the Archaic into Early, Middle, and Late subperiods, notwithstanding the arguments of Custer (1984, 1986a) and others (e.g., Johnson 1986) that new chronological frameworks may be more appropriate. The traditional division of the Archaic into Early, Middle, and Late subperiods is particularly applicable to the Site 7S-F-68 chronology, as these divisions correspond roughly to the site's two intervals of intensive occupation (Early Archaic and Late Archaic), separated by an interval of relative abandonment or infrequent use (Middle Archaic).

As traditionally defined, the Archaic period represents the longest chronological unit of human occupation in the eastern United States, but very little is known about cultural development during the seven millenia that followed the end of the most recent ice age. Caldwell's (1958) primary forest efficiency model posits a period of increasing familiarity with the environment which allowed more efficient exploitation of seasonally abundant food resources and which ultimately permitted an increase in population and led to greater social complexity. Following this model, the Archaic has been viewed traditionally as a period of gradual, steady population increase. If one accepts the assumption that the number of diagnostic projectile points is directly related to population size, the results of excavation at Site 7S-F-68 do not support a model of gradual, steady population increase during the Archaic.

A similar paucity of Middle Archaic diagnostics was also noted at the Indian Creek V Site (18PR94), a gathering camp or base camp in Prince Georges County, Maryland (LeeDecker et al. 1991). There is also a general scarcity of radiocarbon dates that fall in the Middle Archaic period for the Middle Atlantic region (Gleach 1985, 1987). Rather than a stable or slowly expanding population, these site chronologies suggest a virtual depopulation during the Middle Archaic or a dramatic change in land-use patterns. Elsewhere in the Middle Atlantic Coastal Plain, Steponaitis (1980) and Wanser (1982) have noted an apparent scarcity of components dating to the 6000-5000 BC interval. Particularly for the Coastal Plain region, one must also consider the possibility that evidence of Middle Archaic activity has been drowned by rising sea levels. These issues cannot be examined fully in the context of a single site report; however, the data from Site 7S-F-68 do not support the model of steady or gradually expanding population levels during the Archaic period.

Use of the site during the Woodland period is evident not only from a series of radiocarbon dates but also from the recovery of diagnostic points and ceramics. Four radiocarbon dates obtained from the site fall in the Woodland period, as it is traditionally defined: 1960 ± 70 years BP (Beta-56050), 1260 ± 70 years BP (Beta-56044), 1140 ± 60 years BP (Beta-46395), and 310 ± 80 years BP (Beta-56050).

The Woodland period diagnostic artifacts in the assemblage are most indicative of occupation or use of the site during the Late Woodland, or Woodland II, period. These artifacts include shell-tempered fabric-impressed sherds from only one or two vessels of Townsend/Rappahannock ware, and a triangular jasper projectile point. A few ceramic sherds with sand and grit temper may represent Early or Middle Woodland components. A group of twelve stemmed points comprise a variety of types whose temporal affiliation includes the Late Archaic to Early Woodland; among these are the Teardrop, Rossville, Koens Crispin, and Broadspear types. Given the regional point typologies, it is difficult to identify discrete Early or Middle Woodland (Woodland I) components.

Based upon palynological and geomorphological data for the Middle Atlantic region, Custer and Bachman (1984) have described the Woodland I period (ca. 3000 BC - AD 1000) as a time of "dramatic change in local climates and environments" in which "a pronounced warm and dry period" (i.e., a mid-postglacial xerothermic) began at approximately 3000 BC and persisted to approximately 1000 BC (Custer and Bachman 1984). During that period, the mesic oak-hemlock forests of the Archaic were replaced by more drought-resistant (xeric) oak and hickory forests and more abundant grasslands. Although these conditions resulted in the loss of some interior streams, continued sea level rise resulted in the creation of highly productive and large brackish water marshes in the coastal zone.

In turn, these shifts in climate, environmental conditions, and resource distributions are believed to have resulted in radical changes among resident prehistoric Native American populations, including a trend toward greater sedentism and more complex social organization. Major river floodplains and estuarine swamp habitats became the primary resource zones and the locations of large residential base camps occupied on a multi-seasonal or year-round basis. In southern Delaware, there was an increase in the utilization of shellfish in the coastal areas, concurrent with an inland shift in the locations of macroband base camps along the tidal drainages. Within the Mid-Peninsular Drainage Divide zone, there is little evidence that site distribution patterns changed significantly from the preceding Archaic period (Custer 1986a), and the continuity in use of Site 7S-F-68 during the Archaic and Woodland periods suggests some similarity in the settlement patterns during both periods. However, the latter part of the xerothermic interval, corresponding to the Middle Woodland period as traditionally defined, may have been characterized by less frequent use of Site 7S-F-68, possibly as a result of a diminished carrying capacity for the surrounding wetland area.

Custer has characterized the Woodland II period (ca. AD 1000 - 1650) in Delaware as a period of increased sedentism, marked primarily by the development of horticulture. During this period, villages became larger and more permanent, and were typically located adjacent to areas with easily worked floodplain soils. In southern Delaware, the Slaughter Creek complex is characterized by the presence of Townsend ceramics, triangular projectile points, large macroband base camps and possibly fully sedentary villages with numerous food storage features. Most major sites assigned to the Slaughter Creek complex have been identified in the Delaware Shore, Mid-Drainage, and Coastal/Bay physiographic zones (Custer 1984, 1986a). The Late Woodland component at Site 7S-F-68 includes Townsend ceramics and a triangular projectile point, and would therefore be defined as a special resource procurement site within the Slaughter Creek complex settlement pattern.

B. SUBSISTENCE

Excavation of Site 7S-F-68 has produced direct and indirect evidence of various types concerning subsistence patterns; however, the results illustrate many of the difficulties archaeologists face in the interpretation of prehistoric subsistence. The recovery of numerous projectile points provides indirect evidence that hunting figured prominently in the overall subsistence pattern; yet, the preservation of bone was virtually nil. Some information regarding subsistence was gained from analysis of residues adhering to the surfaces of stone tools, and perhaps equally importantly, some of the issues regarding the validity of various residue testing methods were addressed. Finally, a small but analytically significant botanical assemblage was recovered by flotation processing.

Analysis of the catchment area surrounding the site indicates that it would have provided a somewhat unique suite of subsistence resources. Located within the Mid-Peninsular Drainage Divide physiographic zone, the site occupies a low knoll or ridge that stands a few feet above a vast expanse of upland wetland areas. In addition to its flat topography and the slow-moving headwaters of the streams that empty into the Delaware and Chesapeake bays, the Mid-Peninsular Drainage Divide zone is an area of bay/basin features and swamps surrounded by sand ridges (Custer 1984, 1986a). Although the site is surrounded by a vast expanse of wetland areas, there is no visible stream channel in the vicinity. While the site itself occupies a well-drained ridge, formal analysis of the vicinity suggests that the site location was chosen to provide maximum access to resources in the nearby swampy woodland areas.

The vegetation of the swampy woodland areas surrounding the site is very dense, a setting that affords excellent cover for wildlife such as turtles, snakes, ducks, deer, bear, squirrel, rabbit, mink, otter, muskrat, turkey, and beaver. Deer and other browse-oriented species find this habitat especially attractive (Thomas et al. 1975). Numerous floral resources are available in wetland areas, providing a wide variety of seeds, roots, tubers, and leafy greens of known ethnographic use for food, medicine, and other purposes. Riverine and estuarine fauna such as mink, otter, weasel, waterfowl, shellfish, and anadromous fish would have been virtually absent from the catchment area surrounding Site 7S-F-68, but they were important subsistence resources in other physiographic zones.

Small, seasonally occupied sites in the Middle Atlantic region, such as Site 7S-F-68, have rarely provided direct archaeological information (i.e., dietary remains) pertaining to subsistence. These sites typically lack storage features or well-preserved midden deposits, and existing models of subsistence behavior are, for the most part, based on the inferred resources associated with individual site environments (Wesler 1985:219). In a large measure, Site 7S-F-68 fits the typical pattern of small upland sites in the Middle Atlantic region, in that the site lacked a well-preserved faunal assemblage. The assemblage provides relatively little direct subsistence information, but it does suggest that the diet may have included small birds the size of pigeon and quail. While there was no direct evidence for the use of specific fauna, the condition of the bone with regard to charring and burning suggested that the hearth areas at the site were not used for prolonged periods. The paucity of formal cooking areas in the site's feature inventory supports this interpretation.

An extensive program of residue analysis was undertaken in the hope that subsistence information could be gleaned from the stone tools recovered from the site. Overall, the results indicate that deer were an important resource to the groups that occupied the site, and that the overall subsistence pattern included a broad range of fauna, including large-game animals (deer, bear, and bison or possibly elk), small-game animals (rabbit, beaver or squirrel, and wolf or fox), and upland game birds (wild turkey or grouse or quail). A preference for upland game is evident, as is the lack of positive results for aquatic and riverine fauna such as duck and trout. Given the site's environmental context, the positive residue tests indicate that the site was used as a campsite for groups hunting upland game. When examined according to cultural periods, the findings conform to accepted notions of Archaic subsistence, but there are insufficient data to characterize Woodland faunal procurement patterns.

It must be noted that the techniques for residue analysis are relatively new and their analytical value is not yet fully understood. A two-stage program was designed for the Site 7S-F-68 assemblage, in order to evaluate the efficacy of the various testing methods available. The Level I (presence/absence) testing involved a total of 186 lithic artifacts, of which only seven tested positive--one biface and six pieces of debitage. A total of 50 specimens were submitted for Level II testing, including the seven that tested positive and eleven that tested negative during the Level I evaluation. The latter were specifically included in the Level II sample as a means of cross-checking the two techniques. The correlation between the Level I and Level II results was very low; only one of the artifacts that tested positive for presence of residue (Level I) had any reaction during the Level II testing. There are a number of possible explanations for the lack of agreement of results from the two techniques, but it is clear that presence-absence testing with chemstrips is not an effective method for predicting which artifacts will produce positive results at the family level.

A small amount of floral material was identified in the site assemblage, primarily by the use of flotation recovery techniques. The analytically significant sample includes five native plant types--cherry, hickory, sumac, sumpweed, and woodbine. Although only a small amount of floral material was recovered, the floral assemblage has important interpretive value. There is documented ethnographic use of both woodbine as a medicinal herb and sumac as a dye, medicinal herb, cordage and a smoking material. There is documented use of cherry both for food and as a medicinal, and hickory nuts were used as food and as a fuel for hot, smokeless fires. Sumpweed *(Iva annua)* was one of the earliest domesticated plants in eastern North America, and it has been recovered from contexts dating as early as 7,000 BP (Smith 1992a, 1992b). It is also worth noting that other important starchy grains were recovered from the site area. Chenopodium, amaranthus, and knotweed were all present within the studied samples. Although they were not recovered in the charred state and are thus not considered analytically significant, it is possible that they were present and used during the prehistoric occupation of the site. Considering the entire assemblage of recovered botanicals, both charred and uncharred, there was a variety of starchy grains, herbs, nuts, and fruits available in the site area which could have been exploited by prehistoric groups.

Sumpweed was the most significant botanical material recovered from the site, and it was recovered from contexts associated with the Middle AU (Late Archaic/Early Woodland) and Late AU (Late Woodland). Sumpweed is an indigenous annual seed plant which played a prominent role in eastern North America in the transformation from gathering of wild plants to intensive agriculture. Sumpweed has been recovered from numerous archaeological contexts in the midwest riverine region of North America, and there is evidence of its extensive manipulation by prehistoric populations. Smith (1992a, 1992b) has reviewed the evidence and developed a general model of the processes leading to maize-centered field agriculture that was a primary trait of late prehistoric cultures throughout eastern North America.

Before 7000 BP, there is evidence for occasional use of various seeds, berries, and nuts by small foraging groups. During the following three millenia (circa 7000 - 4000 BP), hunter-gatherer settlements were concentrated in areas adjacent to abundant aquatic resources, which provided ample sources of animal protein. Through the continued reoccupation of seasonal campsites in these settings, "anthropogenic" habitats were created; various human activities such as the clearing of occupation areas, the building of shelters, drying racks, cooking areas, storage features, and the disposal of refuse would have created areas of enriched, disturbed soil that were quickly colonized by pioneer weed species. At this stage, while human groups were creating enriched anthropogenic habitats, or domestilocalities, they also may have actively dispersed plants with recognized subsistence value or simply tolerated their growth at the margins of their occupation areas (Smith 1992a, 1992b).

During the period from 4000 to 3500 BP, three annual seed crops were brought under cultivation--sumpweed, sunflower, and goosefoot. At this stage, human groups would have actively encouraged the development of these species, by discouraging the growth of competing species and possibly by the expansion of the anthropogenic habitat. Available evidence indicates that sumpweed was the first of the three indigenous seed crops brought under cultivation, and the evidence consists of the increasing length of the achene. For sumpweed, a mean achene length greater than 4 mm is viewed as a domesticated crop, and modern wild species have a mean length ranging from 2.5 to 3.2 mm (Smith 1992a, 1992b). The sumpweed sample recovered from Site 7S-F-68 certainly falls above the threshold length for the cultivated variety.

The final stage in the development of an agricultural complex was the deliberate planting and harvesting of plants within domestilocalities. The earliest agricultural communities developed in the midwest during the period from 3000 to 1700 BP. In the Eastern Woodland, at least seven plants were cultivated by the earliest farming communities: these included goosefoot, knotweed, maygrass, little barley, sumpweed, sunflower, and gourd. A field agriculture system developed in the period from 1700 to 800 BP; maize first appeared in this period, but it did not become an important crop until the late prehistoric period, after 800 BP. While a maize-centered field agricultural system was a prominent feature of the late prehistoric subsistence pattern, the agricultural complex included many other cultigens, such as beans, squash, and amaranth, as well as many of the originally cultivated plants such as sumpweed, sunflower, goosefoot, maygrass, knotweed, and little barley. Thus, the emergence of maize agriculture was not a revolutionary development, but rather a continuation of a subsistence pattern that had developed over a period of thousands of years (Smith 1992a, 1992b).

At Site 7S-F-68, sumpweed was present in contexts dating to 2460 $\pm$ 130 years BP (Feature 19), 1020 $\pm$ 70 years BP (Feature 17), and 310 $\pm$ 80 years BP (Feature 20). Feature 26 also contained sumpweed, but there was insufficient material from this context for a radiocarbon age determination. The contexts are representative of the period after the initial domestication of sumpweed, and suggest that sumpweed continued to play a role in the Middle Atlantic subsistence pattern from the Terminal Archaic through the Late Woodland/Contact periods. The environmental setting of Site 7S-F-68 appears to have provided an ideal habitat for sumpweed, as it favors areas where the soils are saturated for long periods, areas at the border of well-drained and poorly drained soils, and areas of disturbed ground (Asch and Asch 1978). With the continued reoccupation of Site 7S-F-68 from the Early Archaic period, and possibly the Paleoindian period, creation of a suitable anthropogenic habitat, or domestilocality, would have occurred, and the expanse of poorly drained soils in the surrounding area would have provided ample areas for the cultivation of large, dense stands of the plant. Moreover, the local sandy soils would have been ideally suited for simple hoe agriculture, similar to that of the natural levees along the major river systems of the midwest where the first agricultural communities developed in eastern North America (Smith 1992a, 1992b).

Sumpweed seed clusters could have been harvested simply by hand stripping or beating the clusters into baskets. Processing of sumpweed seed clusters would have required some method for removal of the hard, protective seed coat; such methods may have included use of a wooden mortar board or a milling stone (Smith 1992b). The lithic assemblage included a number of items that could have been used in plant food processing: a milling stone complex, represented by a mano and metate (Feature 22), and a number of cobble tools that exhibited wear as grinding stones (manos), nutting stones (pitted cobbles), and hoe blades or grubbing tools. Interestingly, most of these items were located in the South Excavation Block and are apparently associated with the Early AU contexts, which is most representative of the Early Archaic occupation. If this cultural association is correct, it would imply a very early focus on plant food exploitation at this site.

The traditional view in the Middle Atlantic region is that Paleoindian and Early Archaic subsistence behaviors were almost wholly dominated by hunting; however, some investigators have challenged that view (e.g., Kauffman and Dent 1982), citing the results of a few sites where systematic flotation recovery techniques have been applied. Many investigators (e.g., Carr 1974; Custer 1984; Gardner 1974) in the Middle Atlantic recognize that a significant shift in the settlement pattern occurred during the Early Archaic period, specifically the appearance of processing stations at the margins of wetland habitats (floodplains, marshes, and swamps). These microenvironments would have supported a broader variety of exploitable plant and animal species; hence they became favored site locations for the hunter-gatherer populations of the Early Archaic. While the traditional Archaic hunter-gatherer subsistence model posits seasonal gathering of plant foods, botanical material has rarely been recovered from archaeological contexts in the region, and the current understanding of Archaic subsistence largely emphasizes the importance of animal foods.

The preservation of botanical material at open sites in the Middle Atlantic Coastal Plain is unusual, although there have been some important exceptions, most notably at the Indian Creek V Site in Prince Georges County, Maryland (LeeDecker et al. 1991). The Indian Creek V Site was interpreted as a gathering camp/processing site that was repeatedly visited for short periods to exploit seasonally available plant and animal resources. Flotation samples from the site contained 63 taxa representing a wide variety of fruit, tubers, starchy seeds, nuts, shoots, and leaves, and nearly all of the charred, native botanical specimens represented species of known ethnographic use. Flotation recovery at other sites in the Middle Atlantic region, including the present investigation of Site 7S-F-68, is providing more and more evidence of plant use among Archaic and Woodland populations.

C. SETTLEMENT PATTERNS

Excavations at Site 7S-F-68 have produced evidence of occupation or use during each of the major periods of Delaware prehistory; as such, the site has contributed much information relevant to understanding the prehistoric use of the Mid-Peninsular Drainage Divide physiographic zone.

Based on the research of William Gardner and his colleagues in the Virginia Valley and Ridge province and neighboring areas, regional models of Paleoindian settlement patterns emphasize that the movements of small groups centered around high-quality cryptocrystalline lithic source areas. However, there are no comparable primary lithic source areas in the Coastal Plain, and although scattered finds of fluted points have been reported, it has been difficult to define a distinctive Paleoindian settlement pattern for this area.

In Delaware, Custer has noted a concentration of Paleoindian sites in the Mid-Peninsular Drainage Divide. Using LANDSAT satellite imagery to characterize the environmental composition of this zone, he determined that most Paleoindian sites were located at the margins of poorly drained areas. The Hughes complex of sites in Kent County is characterized by a series of Paleoindian sites located on low knolls of well-drained soil that are surrounded by poorly drained areas (Custer 1984, 1986a). This typical setting corresponds well to that of Site 7S-F-68, which suggests that the basic settlement model for the Hughes complex would extend throughout the Mid-Peninsular Drainage Divide zone.

Following Gardner, Custer's models for the overall Paleoindian settlement system in Delaware emphasize the importance of obtaining high-quality cryptocrystalline lithic materials. The limited evidence of Paleoindian activity at Site 7S-F-68 suggests the use crystal quartz, rather than cryptocrystalline material such as chert or jasper. Site 7S-F-68 lies within a lithic-poor setting, lacking in both primary and secondary sources of lithic material suitable for stone tool manufacture. The crystal quartz that was used at the site would have been available in the uplands north of the Fall Line and in secondary deposits south of the Fall Line, but it is most likely that a primary source was used, i.e., bedrock crystal. In central and northern Delaware, Custer argues that the Paleoindian settlement pattern was cyclical in nature, with individual groups periodically returning to a single lithic source. In an alternative model, which proposes serial settlement, it is suggested that groups would have replenished their lithic tool kits at a series of different lithic sources that were scattered across the landscape, while engaged in other procurement or exploitative activities (Custer 1984). The limited evidence of Paleoindian activity at Site 7S-F-68 is not clearly indicative of a serial or cyclical system for the southern Delmarva Peninsula, and more data is needed to address this issue.

Given the limited evidence of Paleoindian activity at Site 7S-F-68, it is likely that the site was used only on a short-term basis. The crystal quartz lithic assemblage suggests that activities associated with tool manufacture and processing of game were carried out at the site. In Custer's settlement model, the Paleoindian component at Site 7S-F-68 would be classified as a hunting site (Custer 1984, 1986a).

Following occasional or periodic visits by Paleoindian groups, Site 7S-F-68 appears to have been used most intensively during the Archaic and Woodland periods. In Delaware, Archaic and Woodland settlement patterns were generally characterized by seasonal movements through a series of habitats that provided various plant and animal foods at different times of the year. Different settlement types, distinguished by the group size and activities, were established during the annual round. The Archaic settlement pattern model includes macroband base camps, microband base camps and procurement sites (Custer 1984, 1986a). The lithic assemblage, the botanical assemblage, and the features suggest that Site 7S-F-68 functioned as a procurement site, rather than a base camp, during the Archaic and Woodland periods. The site appears to have been a short-term habitation area that was frequently reoccupied. The most common of the recognizable activities carried out at the site were chipped-stone tool production, tool maintenance, and the procurement and processing of foodstuffs. The large numbers of heavily resharpened and/or broken hafted bifaces indicate that much of the lithic reduction was geared toward refurbishing tool kits, specifically refitting projectiles with new points. These refurbishing tasks were apparently conducted in concert with exploitative and processing tasks, as represented by hafted bifaces, cobble tools, and unifacial tools. Neither the Archaic nor the Woodland occupations appear to have been of lengthy duration; rather, the lithic assemblage seems to indicate that the site was frequently reoccupied but for short periods of time.

The initial period of intensive or frequent use of the site occurred during the Early Archaic. Custer has argued that in the Delmarva Coastal Plain a significant adaptive change occurred at the beginning of the Archaic, marked by a changing emphasis in site locations. Specifically, this settlement shift is seen as an increased emphasis on the swamp and marsh habitats that developed at the beginning of the Atlantic climatic episode (Custer 1984, 1986a). Investigations at Site 7S-F-68 do not support the idea of a shift in settlement locations, given the continuity in site use from the Paleoindian to the Early Archaic period. Instead, the data suggest increasingly intensive use during the Early Archaic of the wetland habitats that were previously exploited during the Paleoindian period. The addition of tools associated with plant food exploitation such as milling stones, grubbing tools, and hoes suggests that the Archaic populations became increasingly familiar with the resources of the wetland habitats and began to exploit a wider range of the available plant resources. While the wetland areas remained attractive to game animals, the availability of specific botanical resources would have been more predictable, and an expansion of the subsistence base to include a broader range of biotic resources would have supported larger populations.

Middle Archaic settlement models for the Middle Atlantic region are not well developed, and there is a lack of agreement regarding bracket dates for that period. Site 7S-F-68 contained limited evidence of Middle Archaic occupation, and little can be said of this component other than that it provides some evidence of continuity in the basic settlement pattern. The one Middle Archaic diagnostic point was a side-notched rhyolite point assigned to the Otter Creek point type. Rhyolite accounted for a very small fraction of the lithic assemblage, and it is possible that all of the rhyolite is associated with the Middle Archaic component. Rhyolite is not available in the Coastal Plain, and the likely source of this material is the South Mountain area of northern Maryland and southern Pennsylvania. The presence of rhyolite at Site 7S-F-68 is most likely the result of either of two different procurement strategies: (1) direct procurement, perhaps linked to seasonal movements between the highlands and the Coastal Plain; or (2) indirect procurement, i.e., exchange networks. Through the Archaic period there is a pattern of increasing reliance upon locally available materials at the expense of "exotic" materials such as rhyolite. The absence of rhyolite after the Middle Archaic thus conforms to the traditional interpretation of the Late Archaic as a period of reduced settlement mobility and more restricted territories.

Late Archaic cultures in the Middle Atlantic Coastal Plain are characterized by increased sedentism and larger population aggregates. Custer (1984, 1986a) has described the change from Archaic to Woodland settlement patterns in Delaware as essentially a shift form mobile to more sedentary patterns, but he subsumes the traditional Late Archaic period into the Woodland I period. In that period, he has observed, the distinctive characteristics of the settlement system are (1) the presence of base camps along major drainages that supported much larger population aggregates and (2) a corresponding abandonment of sites in other locations. The intensification of settlement in the major riverine zones is seen as a response to the warm, dry conditions associated with the Subboreal climatic episode, which possibly decreased the carrying capacity of marginal areas that were exploited during the Atlantic climatic episode (Custer 1984, 1986a).

The excavations at Site 7S-F-68 do not support this model, at least that element of the model that posits abandonment of marginal areas. Located within the Mid-Peninsular Drainage Divide zone, the Site 7S-F-68 environment would be considered marginal because of its isolation from riverine resources. Its catchment area is dominated by seasonally flooded wetlands, but there are no nearby stream channels that would have supported the types of riverine resources (anadromous fish and shellfish) that were so intensively exploited at base camps along major drainages. Nonetheless, the site produced abundant evidence of frequent occupation during the Late Archaic period. The evidence suggests that Site 7S-F-68 continued to function as a seasonal procurement site where the groups exploited a variety of game and botanical resources.

Continuity in the settlement pattern from the Late Archaic through the Early and Middle Woodland periods is evident throughout the Middle Atlantic region, and this continuity of settlement patterns is perhaps the most compelling argument in support of Custer's (1984) chronology, which lumps the Late Archaic, Early Woodland, and Middle Woodland into a Woodland I unit. The Woodland I settlement pattern is similar to the Archaic model, and it includes the same types of sites, but the Woodland I macroband base camps are much larger than the Archaic macroband base camps. Radiocarbon dates indicate the continued use of Site 7S-F-68 through the Early and Middle Woodland period, but there is a lack of diagnostic ceramics associated with these periods.

The Woodland II settlement system also includes the same three basic site types, and the increased emphasis on cultivated foods in the diet presumably led to important changes in the Late Woodland or Woodland

II settlement patterns. In Delaware, Late Woodland settlement patterns were characterized by increased sedentism, which was reflected in larger villages located adjacent to areas of easily tilled soils, construction of more permanent structures, and increased use of food storage facilities (Custer 1984, 1986a). However, these changes appear to reflect a shifting emphasis in long established patterns rather than a fundamental shift. A review of data for the Late Woodland in the Delaware Valley and Upper Delmarva Peninsula concluded that there was a general continuity in settlement/subsistence systems from the Middle to Late Woodland periods (Stewart et al. 1983). The continued use of Site 7S-F-68 indicates that, despite a greater concentration of Late Woodland populations in the coastal zone and the lower reaches of major drainages, seasonal procurement sites in the Mid-Peninsular Drainage zone continued to be used.

There are different settlement models for the Late Woodland, based on variations in the seasonal movements between environmental zones. For southern Delaware, a number of settlement pattern models have been proposed for the Late Woodland Slaughter Creek complex (Thomas et al. 1975). The excavations at Site 7S-F-68 have produced evidence of a definite pattern of seasonal use, which has direct implications for the alternative settlement pattern models developed by Thomas et al. (1975). The site's botanical assemblage, consisting of hickory nuts, sumac, cherry, sumpweed, and woodbine, is most clearly indicative of use of the site during the autumn months. Hickory nuts are at their peak from late September through early October. Sumac fruits between August and October, although the root and stemstalk would be available all year. Cherry trees produce fruit in the early fall, from late August through September. Sumpweed achenes ripen around the middle of October. Ordinarily some hickory nuts would be available but in declining abundance when sumpweed is ready to harvest. Woodbine, which is in profusion during late summer (June through August), is the only one of the analytically significant botanicals recovered that deviates from the pattern of autumn procurement. These results are most consistent with Model 4 of Thomas et al. (1975), which posits that the Poorly Drained Woodland zone would have been most attractive for exploitation during the fall to late winter.

Analysis of the lithic assemblage also provided information pertinent to the issue of settlement patterns. Specifically, examination of the patterns of raw material procurement focused on the question of whether groups exploited secondary cobble sources that were available in the Coastal Plain or whether they preferred primary sources which were available only above the Fall Line. This question is tied closely to the issue of cyclical versus serial settlement patterns. The types of cortex present on the lithic artifacts pertain directly to this question. Simply stated, the presence of cobble cortex implies exploitation of local secondary sources, while block cortex implies procurement of raw materials from somewhere at or above the Fall Line.

The presence of block and cobble cortex indicates that both primary and secondary sources were exploited by the groups that visited Site 7S-F-68, but the ratios show that secondary (cobble) sources were exploited more frequently than primary sources. This pattern is certainly not unexpected, given the site's Coastal Plain setting. The quartz assemblage most strongly expresses this pattern of local procurement, and is followed by jasper, chert, quartzite, chalcedony, and igneous/metamorphic materials. It is clear that cobble sources were exploited much more frequently than bedrock sources, especially for the most commonly used raw materials. This finding is at odds with Lowery and Custer's (1990) analysis of the lithic assemblage from the nearby Crane Point Site; they argued for the almost exclusive use of primary lithic sources, with these materials being transported onto the Delmarva Peninsula as bifacial cores.

This question of changing lithic procurement patterns through time can be addressed by examining the culturally diagnostic bifaces and by the deposits associated with the analytical units. Changing procurement patterns through time are evident in the biface assemblage: the possible Paleoindian component utilized crystal quartz; the Early Archaic component primarily utilized jasper and chert; the Middle Archaic component utilized rhyolite; the Late Archaic/Early Woodland component used more argillite than any other raw material; and the Late Woodland component utilized jasper. With the exception of rhyolite, argillite, and crystal quartz, all of these raw materials are available on the Delmarva Peninsula.

The Early AU is dominated by jasper, chert, vein quartz, and quartzite, and it is likely that the majority of these materials in the Early AU are related to the Early Archaic occupation. In the Early AU, cobble cortex is far more plentiful than block cortex, indicating a primary use of locally available cobble sources. It is likely that bedrock sources were exploited, but the lack of cortex does not provide direct evidence of bedrock procurement, since similar raw materials were locally available in secondary deposits. Middle Archaic groups, represented by the Otter Creek component, and Late Archaic/Early Woodland groups did bring nonlocal raw materials--rhyolite and argillite--onto the Delmarva. The same pattern of nonlocal procurement may also apply to the Paleoindian component, with its utilization of crystal quartz. Overall, the Site 7S-F-68 assemblage is more comparable to that of the Paw Paw Cove Site (Lowery 1989) than the Crane Point Site (Lowery and Custer 1990); the lithic assemblage indicates that Early Archaic and other groups that used Site 7S-F-68 exploited cobble sources more intensively than bedrock sources, no doubt because secondary sources were closer and because they contained sufficient quantities of cryptocrystallines (chert and jasper) to make exploitation worthwhile.

D. INTRASITE PATTERNING

Site 7S-F-68 has been interpreted as a periodically revisited procurement site at which a limited variety of extractive and maintenance tasks were carried out. These activities included food processing, consumption, discard of waste, and tool manufacture and maintenance. Although these activities may be inferred individually on the basis of excavated features, tools, and waste material, activity-area reconstruction focuses on the spatial arrangement of these activities within the site.

While there was much overlapping of deposits from discrete occupational episodes and mixing of deposits between analytical units, internal site patterning was evident from various perspectives. First, there were many examples of diagnostic point types clustering in certain areas, indicating that individual occupational phases or episodes occurred within fairly restricted areas of the site. Second, there were a number of lithic raw material concentrations in well-defined areas of the site, indicating the presence of well-preserved refuse disposal areas. In some cases, concentrations of tools and debitage were identified adjacent to a hearth area, indicating that the hearth area was a focal points for activities within the site's primary habitation area.

There were a limited number and variety of feature types at the site. The feature inventory includes only one formal cooking/heating area, represented by a concentration of FCR, although other features suggest the presence of some informal cooking or heating areas throughout the site. Deposits associated with the Early Archaic occupations of the site were concentrated in the South Excavation Block and were apparently related to with the formal cooking/heating area. A plant food processing area represented by a mano and metate were also located in this part of the site. While the spatial analysis showed a consistent pattern of Early Archaic projectile points, debitage, and cobble tools in the South Block, it was also observed that the unifacial tools associated with these occupations were more widely distributed over the site area, possibly representing secondary activity areas used for tasks such as hide processing. The Early Archaic use of a hearth area as a focal point of activities within a campsite conforms to a large body of ethnographic and excavation data for hunter-gatherer cultures (Binford 1983).

Although there was only limited evidence of Paleoindian occupation of the site, the assemblage of crystal quartz tools and debitage associated with this component was concentrated in a small area on the western margin of the site. Feature 21, an activity area consisting of a cobble chopper and hoe, was within this area of Paleoindian activity, but it is more likely associated with the Early Archaic component.

The distribution of Late Archaic/Early Woodland points and associated raw material concentrations within the site also exhibited a distinct spatial pattern. Most of these points and associated refuse were located in the North Excavation Block, suggesting a shift in the primary occupation area within the site. This part of the site did not contain a formal cooking area, but it did contain a number of charcoal concentrations that may represent informal cooking or heating areas. Identification of spatial patterning associated with the Late Woodland component was limited by the fact that the Late AU contexts had been subjected to various post-depositional disturbances, particularly historic cultivation, roadway construction, and use of the site as a cemetery.

E. ENVIRONMENTAL ADAPTATION

The environmental adaptation theme examines cultural response to environmental conditions, and it is closely related to the settlement pattern theme. The site occupies a low ridge surrounded by an expanse of poorly drained upland wetlands. Catchment analysis suggests that the critical factor in the choice of site location was to maximize access to these wetland habitats. The wetland environment would have been an attractive wildlife habitat, with numerous biotic resources that could have been exploited by hunting, foraging, and collecting. The site area did not afford access to lithic resources nor did it provide the type of riverine resources that were exploited in base camps located along stream and river channels.

Given the lengthy period during which the site was reoccupied and the region's paleoclimatic history, it was anticipated that the archaeological record might reflect cultural responses to changing environmental conditions. However, the data recovery program did not provide a significant opportunity to reconstruct the local paleoclimatic history, as a survey of the site area did not identify any suitable locations for extraction of pollen cores or other direct evidence of the changing prehistoric environments. Baseline data from the surrounding region provide only a general context for understanding the local Holocene environmental sequence.

One of the most notable aspects of the archaeological record at Site 7S-F-68 is that it contains evidence of periodic short-term use during all major periods of Delaware prehistory. Thus, the central issue in addressing the environmental adaptation theme is understanding why this particular locale was periodically revisited over a period of nearly ten millenia, virtually the entire Holocene epoch, when profound cultural and environmental changes were occurring. Using regional environmental data and site-specific information about changing tool kits and subsistence patterns, this issue may be addressed by reference to a general model of cultural adaptation.

When the first Paleoindian groups visited the site, the local environment would have had an early postglacial character. While the regional environment would have been dominated by spruce and fir forests, the mosaic of wetland areas throughout the Mid-Peninsular zone would have offered numerous patchy microenvironments that were attractive to large game animals. The Paleoindian hunting station established at Site 7S-F-68 was no doubt one of many similarly positioned hunting stations, most of which have little or no visibility in the archaeological record. Establishment of a Paleoindian hunting station at Site 7S-F-68 marked the initial creation of an anthropogenic habitat. Modification of the site environment would have been limited at first, but at a minimum it would have required clearing of vegetation and deposition of refuse from the various maintenance and processing activities carried out at the hunting station.

The first intensive period of site use occurred during the Early Archaic, at a time when the regional environment passed through the Preboreal/Boreal and early Atlantic climatic episodes. This interval was marked by a gradual warming and the expansion of a northern hardwood forest at the expense of spruce, and regional models indicate a replacement of the cold-adapted species by a suite of fauna more adapted to warmer conditions. At Site 7S-F-68, the Early Archaic was marked by important changes in the tool kit, most notably the introduction of tools used for processing of plant resources--milling stones, grubbing tools, and hoes. This tool kit and the larger domestilocality associated with the Early Archaic component indicate that the anthropogenic habitat associated with the site would have expanded significantly.

These regional climatic changes associated with the Atlantic episode included a warming trend that was accompanied by an increase in precipitation, which in turn led to an expansion of forests dominated by hemlock and later oak. Throughout the region, the warm, moist conditions of the Atlantic climatic episode are believed to have led to the formation and expansion of wetland habitats. Settlement pattern studies show an expansion of Early Archaic components (represented by bifurcate-based points) into wetland areas that are variously described as interior swamps, freshwater marshes, ponds, bay/basin features, and springheads (Custer 1984; Gardner 1987; Steponaitis 1980; Stewart 1990; Wanser 1982).

Typological evidence indicates use of Site 7S-F-68 throughout the Archaic period, although there is insufficient information to characterize a Middle Archaic occupation. The frequent use of the site during the Late Archaic occurred during the Subboreal episode, an interval of xerothermic conditions which led to an expansion of grasslands and the dominance of an oak-hickory forest type. Squirrel and turkey populations would have benefited from the dominance of nut-bearing trees such as oak and hickory, while species intolerant of dry habitats would have declined. At the regional level, a reduction in the rate of sea level rise occurred during the Subboreal episode allowed stable estuarine environments to form in the tidal areas of the Delmarva. With the formation of these tidal wetland marshes, the Delmarva Peninsula reached its peak carrying capacity, replete with waterfowl, shellfish, and marine fish (Carbone 1976; Custer 1984; Wesler 1985).

At Site 7S-F-68, a shift in the locus of the primary habitation site occurred during the Late Archaic, marked by the distribution of diagnostic points. It is uncertain whether this shift was a response to the regional environmental changes or related to anthropogenic changes in the site habitat. Subsistence data indicate that a domesticated variety of sumpweed was being exploited at the site during Late Archaic times. The domestication of sumpweed, a species that favors the marginal areas of wetlands and disturbed ground conditions such as would be found in anthropogenic habitats, suggests that prior human modification of the local environment had become the most critical factor of the site location by the Late Archaic. Amelioration of the xerothermic conditions at the close of the Subboreal permitted the establishment of modern forest conditions, which continued with minor fluctuations until European contact. At Site 7S-F-68, harvesting of a domesticated variety of sumpweed continued through the Late Woodland period, indicating a continuity in site function until the final replacement of the Native American population by European groups.

F. TECHNOLOGY

Information pertaining to technology is available primarily from analysis of the lithic assemblage. Lithic technology is expressed directly in the tool production technologies that may be identified as distinct industries.

The Middle Atlantic region encompasses a diversity of geological and biological environments that occur in linear zones from the Appalachian highlands to the Atlantic coast. These zones are crosscut by major drainages, including the Delaware River, which terminates in the rich estuarine environments of the lower Delaware Bay. Above the Fall Line, there is a wide assortment of igneous, metamorphic, and sedimentary rocks. Below the Fall Line, these bedrock units are buried by massive sequences of fine sediments and gravels. The absence of bedrock lithic sources in the Delmarva Coastal Plain produced a situation in which the only raw materials that were readily available at Site 7S-F-68 for aboriginal tool production technology were redeposited cobbles and scattered deposits of ironstone.

The area surrounding Site 7S-F-68, including virtually all of the Mid-Peninsular Drainage Divide physiographic zone, falls within a lithic-poor zone, evidenced by the scarcity of cobbles deposits in the site area. Nonetheless, analysis of the lithic assemblage indicated that the groups that used Site 7S-F-68 relied heavily on locally available cobble sources, which contained a range of lithic materials. Four raw materials account for 95 percent of the lithic assemblage: jasper, chert, vein quartz, and quartzite. The dominance of these materials in the lithic assemblage is easily explained by their local availability in secondary deposits. Although these materials are all locally available, there are important differences in how they were used.

The biface industry is the most common industry, represented by hafted bifaces, unfinished bifaces, indeterminate bifaces, and a few miscellaneous types. The unfinished (i.e., early-stage, middle-stage, and late-stage) bifaces are believed to be hafted bifaces that were not completed because they were either rejected for some reason (e.g., breakage or severe hinge fractures) or the production process was halted so they could be stored (cached) and completed at a later date. It is clear that biface production at the site was based primarily upon secondary sources, and the low number of failures and rejects reflects the site's considerable distance from significant raw material sources. Several of the bifaces appear to have been used as knives or scrapers after they broke during production.

Four bifaces are notable in that they do not fit represent hafted bifaces or unfinished tools. One is a very large argillite biface that might more accurately be described as a crude bifacial core. Large flake scars on its surface suggest that large flakes were detached for the production of points. One of the other miscellaneous bifaces is a crudely flaked quartzite block that may have functioned as a chopper, and the other two are believed to be hoe blades or grubbing tools. Both of these exhibit a degree of edge rounding and polishing on their bits which supports interpretation of their use as digging tools. An alternative explanation is that they functioned as high-duty scrapers.

The flake-tool industry is represented by retouched flakes, utilized flakes, endscrapers, sidescrapers, and a denticulated flake. Expedient unifaces--utilized flakes and retouched flakes--were most commonly manufactured from jasper and chert, with a few made of chalcedony, quartz, argillite, igneous/metamorphic material, and indeterminate material. Given the analytical methods used for this study, it is possible that many flakes that were recorded as debitage may have been used briefly. This problem is probably most severe in the quartz assemblage because edge use is difficult to detect on quartz. A similar detection problems occur with argillite, as evidence of use is obliterated by erosion. The formal flake-tool industry is represented by endscrapers, sidescrapers, and the denticulated flake. They were probably hafted and designed to be reused; like the expedient unifacial tools, most were manufactured from jasper and chert.

Three types of cores were identified: tested cobbles, polymorphic cores, and bipolar cores. Tested cobbles may or may not be related to flake-tool production. They are merely cobbles that had one to three flakes removed to inspect the suitability of the cobble, but they were not further reduced. Polymorphic (freehand) cores are cobbles that have had flakes detached in multiple directions; platforms were selected opportunistically and preparation of platforms appears to have been minimal. Bipolar cores were the most common type, and they had the lowest mean weight of the three core types. Bipolar cores are cobbles or pebbles that have had flakes detached by direct hard-hammer percussion on an anvil. Jasper accounts for the great majority of the bipolar cores, followed by quartz and chert. Because bipolar reduction is a technique for maximizing available raw materials, bipolar cores are typically smaller than polymorphic cores. Most flakes and shatter generated by this technique are suitable only for expedient flake tools. However, the popularity of jasper, quartz, and chert in bipolar reduction is directly linked to their fine-grained isotropic structure, which permits detachment of small flakes with clean, sharp, straight edges.

Flakes and chunks cannot be assigned to any single industry. They are general byproducts of chipped-stone tool production, and they constitute more than half of the assemblage. Jasper and chert account for three fourths of the assemblage by count and slightly less than half by weight. The roughly equal numbers of early reduction flakes and biface reduction flakes indicate that, in addition to some level of flake-tool production, both biface production and maintenance were common activities for the jasper and chert assemblage. The quartz assemblage differs in its lower number of biface flakes and higher number of pieces of block shatter; these differences are the result of different fracture mechanics--that is, quartz shatters more readily than chert and jasper. In addition, quartz apparently was more often used for the production of flake tools than for bifaces. The pattern of quartzite debitage suggests both flake-tool production and early- to middle-stage biface production. Rhyolite is only represented by biface flakes and flake fragments, while argillite is represented by these types and by early reduction flakes. The latter flakes indicate different patterns of procurement for argillite and rhyolite.

The assemblage contained only limited evidence of a formal groundstone industry; this was a small fragment of highly polished steatite. The informal groundstone industry (cobble tool industry) includes a number of cobble tools that represent various activities--an abrader, a metate, an anvil stone, two pestles, two manos, two pitted cobbles, seven hammerstones, and a cobble that may have been used as a chopper. The majority of these simple tools are made from quartzite cobbles, and it is likely that most of these cobbles were collected from the same secondary deposits used as a source area for the chipped-stone tools. The two largest cobble tools--a basalt metate and a siltstone pestle--may have been brought to the site from sources near the Fall Line because it is uncertain if cobbles of this size are available on the Delmarva Peninsula; these tools probably represent a plant processing unit. A number of cobble tools had evidence of multiple functions, and two cobble tools were recycled as cooking and heating stones, thus ending up as cracked cobbles in the FCR assemblage. The multiple functions and recycling of cobbles provides additional evidence of the paucity of lithic raw materials in the site area.

REFERENCES CITED

Ahler, S. A.

1971 *Projectile Point Form and Function at Rodgers Shelter, Missouri.* Missouri Archaeological Society Research Series 8.

Ames, David L., Mary Helen Callahan, Bernard L. Herman, and Rebecca J. Siders

1989 *Delaware Comprehensive Historic Preservation Plan.* Center for Historic Architecture and Engineering, College of Urban Affairs and Public Policy, University of Delaware. Newark.

Asch, David, and Nancy Asch

1977 Chenopod as Cultigen: A Re-Evaluation of Some Prehistoric Collections from Eastern North America. *Midcontinental Journal of Archaeology* 2(1):3-45.

1978 The Economic Potential of Iva Annua and Its Prehistoric Importance in the Lower Illinois Valley. In *The Nature and Status of Ethnobotany,* edited by Richard I. Ford, pp. 301-341. Anthropological Papers No. 67. Museum of Anthropology, University of Michigan. Ann Arbor.

1985 Prehistoric Plant Cultivation in West-Central Illinois. In *Prehistoric Food Production in North America,* edited by Richard I. Ford, pp. 149-204. Anthropological Papers No. 75. Museum of Anthropology, University of Michigan. Ann Arbor.

Asch, Nancy, Richard I. Ford, and David Asch

1972 *Paleoethnobotany of the Koster Site: The Archaic Horizons.* Reports of Investigations No. 24. Illinois State Museum. Springfield.

Baker, Joseph

1980 The Economics of Weed Seed Subsistence in the Ridge and Valley Province of Central Pennsylvania. In *The Archaeology of Central Pennsylvania, The Fischer Farm Site, A Late Woodland Hamlet in Context,* edited by James Hatch, pp. 205-222. Occasional Papers, No. 12. Pennsylvania State University Press. University Park.

Bettinger, R. L., J. F. O'Connell, and D. H. Thomas

1991 Projectile Points as Time Markers in the Great Basin. *American Anthropologist* 93:166-172.

Binford, Lewis R.

1978 Dimensional Analysis of Behavior and Site Structure: Learning from an Eskimo Hunting Stand. *American Antiquity* 43:330-361.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:225-273.

1983 In *Pursuit of the Past: Decoding the Archaeological Record.* Thames and Hudson, New York.

Binford, Lewis R., and George I. Quimby

1963 Indian Sites and Chipped-Stone Materials in the Northern Lake Michigan Area. *Fieldiana Anthropology* 36:277-307.

Blanton, Dennis

1984 Lithic Raw Material Procurement and Use During the Morrow Mountain Phase in South Carolina. In *Lithic Resource Procurement: Proceedings from the Second Conference on Prehistoric Chert Exploitation.* Susan C. Vehik, editor. Occasional Paper No. 4. Center for Archaeological Investigations, Southern Illinois University at Carbondale.

Brothwell, D. R.
1972 *Digging Up Bones.* Publication No. 704. British Museum. London.

Broyles, Bettye J.
1971 *Second Preliminary Report: The St. Albans Site, Kanawha County, West Virginia.* West Virginia Geological and Economic Survey Report of Archaeological Investigations 3, Morgantown.

Brush, Grace S.
1990 Holocene Palynology of a Coastal Plain Bog. Manuscript on file at the Department of Geography and Environmental Engineering, The Johns Hopkins University, Baltimore.

Bryson, Reid A., David A. Baerreis, and Wayne M. Wendland
1970 The Character of Late-Glacial and Post-Glacial Climatic Changes. In *Pleistocene and Recent Environments of the Central Great Plains,* edited by Wakefield Dort, Jr., and J. Knox Jones, pp. 53-76. The University of Kansas Press, Lawrence.

Byrne, Roger, J. H. McAndrews, and W. D. Finlayson
1974 *Report on Investigation at Crawford Lake.* Royal Ontario Museum, Toronto.

Caldwell, Joseph R.
1958 *Trend and Tradition in the Prehistory of the Eastern United States.* American Anthropological Association Memoir No. 88. Washington, D.C.

Callahan, Errett
1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. *Archaeology of Eastern North America* 7:1-180.

Carbone, Victor A.
1976 *Environment and Prehistory in the Shenandoah Valley.* Ph.D. dissertation, Department of Anthropology, The Catholic University of America, Washington, D.C.

Carbone, Victor, and Bennie Keel
1985 Preservation of Plant and Animal Remains. In *The Analysis of Prehistoric Diets,* edited by Robert Gilbert and James Mielke, pp. 1-19. Academic Press, New York.

Carr, Kurt W.
1974 The Fifty Site: A Stratified Early Archaic Processing Station. In *The Flint Run Complex: A Preliminary Report 1971-73 Seasons,* edited by William M. Gardner, pp. 130-137. Occasional Publication No. 1. Archeology Laboratory, Department of Anthropology, The Catholic University of America. Washington, D.C.

Chaplin, Raymond
1971 *The Study of Animal Bones from Archaeological Sites.* Seminar Press, London and New York.

Chapman, Jefferson
1975 *The Rose Island Site and the Bifurcate Point Tradition.* Report of Investigations No. 1. Department of Anthropology, University of Tennessee. Knoxville.

Chase, Agnes
1948 The Meek Shall Inherit the Earth. In *Grass, The Yearbook of Agriculture,* pp. 8-15. United States Department of Agriculture, U.S. Government Printing Office, Washington, D.C.

Christenson, Andrew L.
1986 Projectile Point Size and Projectile Aerodynamics: An Exploratory Study. *Plains Anthropologist* 31:109-128.

Clark, John E.
1986 Another Look at Small Debitage and Microdebitage. *Lithic Technology* 15:21-23.

1988 *The Lithic Artifacts of La Libertad, Chiapas, Mexico: An Economic Perspective.* Papers of the New World Archaeological Foundation 52. Brigham Young University. Provo, Utah.

Cleland, Charles E.
1976 The Focal-Diffuse Model: An Evolutionary Perspective on the Prehistoric Cultural Adaptations of the Eastern United States. *Midcontinental Journal of Anthropology* 1:59-76.

Coe, Joffre
1964 *The Formative Cultures of the Carolina Piedmont.* Transactions of the American Philosophical Society 54(5).

Collins, Michael B., Henry Gray, John Bassett, and Donna Dean Lannie
1979 The Longworth-Gick Site (15JF243). In *Excavations at Four Archaic Sites in the Lower Ohio Valley, Jefferson County, Kentucky,* edited by Michael B. Collins, pp. 471-589. Occasional Papers in Anthropology No. 1. Department of Anthropology, University of Kentucky. Lexington.

Cornwall, I.W.
1956 *Bones for the Archaeologist.* Phoenix House, London.

Cowan, Wesley
1985 Understanding the Evolution of Plant Husbandry in Eastern North America: Lessons from Botany, Ethnography and Archaeology. In *Prehistoric Food Production in North America,* edited by Richard Ford, pp. 205-244. Anthropological Papers No. 75. Museum of Anthropology, University of Michigan. Ann Arbor.

Cox, Donald
1985 *Common Flowering Plants of the Northeast.* State University of New York Press, Albany.

Crabtree, Donald E.
1972 *An Introduction to Flintworking.* The Idaho State Museum Occasional Papers No. 28. Pocatello, Idaho.

Custer, Jay F.
1984 *Delaware Prehistoric Archaeology: An Ecological Approach.* University of Delaware Press, Newark.

1986a *A Management Plan for Delaware's Prehistoric Cultural Resources.* University of Delaware Center for Archaeological Research Monograph No. 2. Newark.

1986b Analysis of Early Holocene Projectile Points and Site Locations from the Delmarva Peninsula. *Archaeology of Eastern North America* 14:45-64.

1988 Late Archaic Cultural Dynamics in the Central Middle Atlantic Region. *Journal of Middle Atlantic Archaeology* 4:39-59.

1990 Early and Middle Archaic Cultures of Virginia: Culture Change and Continuity. In *Early and Middle Archaic Research in Virginia: A Synthesis,* edited by Theodore R. Reinhart and Mary Ellen Hodges. Archaeological Society of Virginia Special Publication 22. Richmond.

Custer, Jay F., and David C. Bachman
1984 *Phase III Data Recovery Excavations of the Prehistoric Components from the Hawthorne Site 7NC-E-46, New Churchman's Road, Christiana, New Castle County, Delaware.* Delaware Department of Transporation Archaeological Series No. 24. Dover.

1986 Analysis of Projectile Point Morphology, Use Wear, and Activity Areas at the Hawthorn Site (7NC-E-46), New Castle County, Delaware. *Journal of Middle Atlantic Archaeology* 2:37-62.

Custer, Jay F., John Cavallo, and R. Michael Stewart
1983 Settlement Patterns in the Middle Atlantic Coastal Plain. *North American Archaeologist* 4:263-275.

Custer, Jay F., and George Galasso
1980 Lithic Resources of the Delmarva Peninsula. *Maryland Archeology* 16(2):1-13.

Custer, Jay F., John Ilgenfritz, and Keith R. Doms
1988a Application of Blood Residue Analysis Techniques in the Middle Atlantic Region. *Journal of Middle Atlantic Archaeology* 4:99-104.

1988b A Cautionary Note on the Use of Chemstrips for Detection of Blood Residues on Prehistoric Stone Tools. *Journal of Archaeological Science* 15:343-345.

Day, G. M.
1953 The Indian as an Ecological Factor in the Northeastern Forest. *Ecology* 34(2):329-346.

De Cunzo, Lu Ann, and Wade P. Catts
1990 *Management Plan for Delaware's Historical Archaeological Resources.* Center for Archaeological Research, Department of Anthropology, University of Delaware, Newark.

Dent, R. Joseph, Jr.
1979 *Ecological and Sociocultural Reconstruction in the Upper Delaware Valley.* Ph. D. dissertation, The American University, Washington, D. C.

Didier, M. E.
1975 The Argillite Problem Revisited: An Archaeological and Geological Approach to a Classical Archaeological Problem. *Archaeology of Eastern North America* 3(1):90-100.

Earle, Alice Morse
1974 *Home Life in Colonial Days.* Berkshire Traveller Press, Stockbridge, Massachusetts.

Ebright, Carol A.
1987 Quartzite Petrography and Its Implications for Prehistoric Use and Archaeological Analysis. *Archaeology of Eastern North America* 15:29-45.

1992 *Early Native American Prehistory on the Maryland Western Shore: Archeological Investigations at the Higgins Site.* Environmental Evaluation Section Archeological Report No. 1. Maryland Highway Administration, Project Planning Division. Baltimore.

Edwards, Robert L., and Arthur S. Merrill
1977 A Reconstruction of the Continental Shelf Areas of Eastern North America for the Times 9,500 and 12,500 BP. *Archaeology of Eastern North America* 5:1-42.

Ellis, Christopher J., and Jonathan C. Lothrop (editors)
1989 *Eastern Paleoindian Lithic Resource Use.* Westview Press, Boulder, Colorado.

Erichsen-Brown, Charlotte
1979 *Medicinal and Other Uses of North American Plants: A Historical Survey with Special Reference to the Eastern Indian Tribes.* Dover Publications, Inc., New York.

Erickson, J. E., and B. A. Purdy (editors)
1984 *Prehistoric Quarries and Lithic Production.* Cambridge University Press, New York.

Evans, June
1984 Position Paper on Late Archaic Projectile Point Types. Paper presented at the Middle Atlantic Archaeological Conference. Rehoboth Beach, Delaware.

Evans, June, and Jay F. Custer
1990 Guidelines for Standardizing Projectile Point Typology in the Middle Atlantic Region. *Journal of Middle Atlantic Archaeology* 6:31-41.

Fernald, M. L.
1970 *Gray's Manual of Botany.* D. Van Nostrand Company, New York.

Flenniken, J. Jeffery
1981 *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site.* Laboratory of Anthropology Reports of Investigation No. 59 Washington State University. Pullman.

Flenniken, J. Jeffery, and Anan W. Raymond
1986 Morphological Projectile Point Typology: Replication Experimentation and Technological Analysis. *American Antiquity* 51:603-614.

Flenniken, J. Jeffery, and P. J. Wilke
1989 Typology, Technology, and Chronology of Great Basin Dart Points. *American Anthropologist* 91:149-158.

Ford, Richard I.
1977 Evolutionary Ecology and the Evolution of Human Ecosystems: A Case Study from the Midwestern U.S.A. In *Explanation of Prehistoric Change,* edited by James N. Hill, pp. 153-184. University of New Mexico Press, Albuquerque.

1985 Patterns of Prehistoric Food Production in North America. In *Prehistoric Food Production in North America,* edited by Richard I. Ford, pp. 1-18. University of Michigan, Ann Arbor.

Foss, J. F., D. S. Fanning, and D. P. Wagner
1978 Loess Deposits of the Eastern Shore of Maryland. *Soil Science Society of America Journal* 42(2):329-333.

Funk, Robert E.
1988 The Laurentian Concept: A Review. Archaeology of Eastern North America 16:1-42.

Gardner, William M.
1974 The Flint Run Complex: Pattern and Process during the Paleo-Indian to Early Archaic. In *The Flint Run Paleo-Indian Complex: A Preliminary Report of the 1971-73 Seasons,* edited by William M. Gardner, pp. 5-47. Occasional Paper No. 1. Archeology Laboratory, Department of Anthropology, The Catholic University of America. Washington, D.C.

1977 Flint Run Paleo-Indian Complex and Its Implications for Eastern North American Prehistory. *Annals of the New York Academy of Sciences* 288:257-263.

1978 Comparison of Ridge and Valley, Blue Ridge, Piedmont and Coastal Plain Archaic Period Site Distribution: An Idealized Transect (Preliminary Model). Preliminary draft on file at The Catholic University of America, Washington, D.C.

1987 Comparison of Ridge and Valley, Blue Ridge, Piedmont and Coastal Plain Archaic Period Site Distribution: An Idealized Transect (Preliminary Model). *Journal of Middle Atlantic Archaeology* 3:49-80.

Gilbert, B. Miles
1973 *Mammalian Osteo-Archaeology.* The Missouri Archaeological Society, Inc., Columbia, Missouri.

Gilmore, Melvin
1931 Vegetal Remains of the Ozark Bluff-Dweller Culture. *Papers of the Michigan Academy of Science, Arts and Letters* 14:83-102.

1977 *Uses of Plants by the Indians of the Missouri River Region.* Smithsonian Institution Bureau of American Ethnology 33rd Annual Report, 1911-1912. Pp. 42-154.

Gleach, Frederick W.
1985 A Compiliation of Radiocarbon Dates with Applicability to Central Virginia. *Quarterly Bulletin of the Archeological Society of Virginia* 40:180-200.

1987 A Working Projectile Point Classification for Central Virginia. *Quarterly Bulletin of the Archeological Society of Virginia* 42:80-120.

Goodyear, Albert C.
1979 *A Hypothesis for the Use of Cryptocrystalline Raw Materials Among Paleo-Indian Groups of North America.* Research Manuscript Series 156. Institute of Archeology and Anthropology, University of South Carolina. Columbia.

1993 Tool Kit Entropy and Bipolar Reduction: A Study of Interassemblage Lithic Variability Among Paleo-Indian Sites in the Northeast United States. *North American Archaeologist* 14(1):1-23.

Gould, Richard A.
1980 *Living Archaeology.* Cambridge University Press. Cambridge, England.

Gould, Richard A., and Sherry Saggers
1985 Lithic Procurement in Central Australia: A Closer Look at Binford's Idea of Embeddedness in Archaeology. *American Antiquity* 50(1):117-136.

Gunn, Charles
1972 Seed Collection and Identification. In *Seed Biology,* vol. III, edited by T.T. Kozlowski, pp. 56-143. Academic Press, New York.

Harrington, James F.
1972 Seed Storage and Longevity. In *Seed Biology,* vol. III, edited by T.T. Kozlowski, pp. 145-240. Academic Press, New York.

Harris, G.H.
1903 *The Life of Horatio Jones.* Publications 6, Buffalo Historical Society.

Hatch, James W.
1980 *The Archaeology of Central Pennsylvania, The Fischer Farm Site, A Late Woodland Halmlet in Context,* edited by James Hatch. Occasional Papers No. 12. Pennsylvania State University Press. University Park.

Hatch, J. W., and P. Miller
1985 Procurement, Tool Production, and Sourcing Research at the Vera Cruz Jasper Quarry in Pennsyvlania. *Journal of Field Archaeology* 12:219-230.

Hayden, Brian
1980 Confusion in the Bipolar World: Bashed Cobbles and Splintered Pieces. *Lithic Technology* 9:2-7.

Hedrick, U.P.
1950 *A History of Horticulture in America to 1860.* Oxford University Press, New York.

Herman, Bernard L., Rebecca J. Siders, David L. Ames, and Mary Helen Callahan
1989 *Historic Context Master Reference and Summary.* Center for Historic Architecture and Engineering, College of Urban Affairs and Public Policy, University of Delaware, Newark.

Holland, C. G., S. E. Pennell, and R. O. Allen
1981 Geographical Distribution of Soapstone Artifacts from 21 Aboriginal Quarries in the Eastern United States. *Quarterly Bulletin of the Archaeological Society of Virginia* 35:200-208.

Holmes, William H.
1897 *Stone Implements of the Potomac-Chesapeake Tidewater Province.* Bureau of American Ethnology Annual Report 15. Washington, D.C.

Holt, Cheryl A.
1990 Plants, Man and Culture: An Edible Model of Consuming Behavior. *Historical Archaeology* 25(2):46-61.

Ireland, William, Jr., and Earle D. Matthews
1974 *Soil Survey of Sussex County, Delaware.* U. S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

Johnson, Michael F.
1986 *The Prehistory of Fairfax County: An Overview.* Heritage Resources Branch, Office of Comprehensive Planning, Falls Church, Virginia.

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference.* Indiana University Press, Bloomington.

Kauffman, Barbara, and Joseph Dent
1982 Preliminary Floral and Faunal Recovery and Analysis at the Shawnee-Minisink Site. In *Practicing Environmental Archaeology: Methods and Interpretations,* edited by Roger W. Moeller, pp. 7-12. Occasional Paper No. 3. American Indian Archaeological Institute.

Kavasch, Barrie
1979 *Native Harvests: Recipes and Botanicals of the American Indian.* Random House, New York.

Keeley, Lawrence H.
1980 *Experimental Determination of Stone Tool Uses: A Microwear Analysis.* University of Chicago Press, Chicago.

Keene, Arthur
1981 *Prehistoric Foraging in a Temperate Forest.* Academic Press, New York.

Keepax, Carole
1977 Contamination of Archaeological Deposits by Seeds of Modern Origin with Particular Reference to the Use of Flotation Machines. *Journal of Archaeological Science* 4:221-229.

Kelly, Robert L.
1988 The Three Sides of a Biface. *American Antiquity* 53:717-734.

Kelso, Gerald K.
1992 *Exploratory Pollen Analysis of Two Milling Stones from Berger Project 883B, Site 7S-F-68.* Prepared for the Cultural Resource Group, Louis Berger & Associates, Inc., by G. K. Kelso, Abington, Massachusetts.

King, Frances B.
1984 *Plants, People, and Paleoecology.* Scientific Papers vol. XX. Illinois State Museum. Springfield.

Kinsey, W. Fred III
1972 *Archaeology in the Upper Delaware Valley.* Anthropological Series 2. Pennsylvania Historical and Museum Commission. Harrisburg.

Knap, Alyson
1979 *Wilderness Harvest.* Pagurian Press Limited, Toronto.

Koldehoff, Brad
1987 The Cahokia Flake Tool Industry: Socioeconomic Implications for Late Prehistory in the Central Mississippi Valley. In *The Organization of Core Technology,* edited by J. K. Johnson and C. A. Morrow, pp. 151-185. Westview Press, Boulder, Colorado.

1990a Household Specialization: The Organization of Mississippian Chipped-Stone-Tool Production. M.A. thesis, Department of Anthropology, Southern Illinois University, Carbondale.

1990b Lithic Analysis. In *The Archaeology of the Cahokia Palisade, Part I: East Palisade Investigations,* by W. R. Iseminger, T. R. Pauketat, B. Koldehoff, L. S. Kelly, and L. Blake. Illinois Cultural Resources Study No. 14. Illinois Historic Preservation Agency. Springfield.

Kraft, Herbert C.
1975 *The Archaeology of the Tocks Island Area.* Archaeological Research Center, Seton Hall University Museum, South Orange, New Jersey.

Kraft, Herbert C., and Michael H. Blenk
1974 The Teardrop Point. *Bulletin of the Archaeological Society of New Jersey* 30:13-14.

Kraft, Herbert C., and R. Alan Mounier
1974 The Archaic Period in New Jersey. In *New Jersey's Archeological Resources form the Paleo-Indian Period to the Present: A Review of Research Problems and Survey Priorities,* edited by Olga Chesler, pp. 52-102. Office of Cultural and Environmental Services, Department of Environmental Protection, Trenton.

Lawrence, Eleanor, and Cecilia Fitzsimons
1985 *Trees.* Atlantis Publications, Ltd., New York.

LeeDecker, Charles H., Martha H. Bowers, Amy Friedlander, and John W. Martin
1989 *Cultural Resource Assessment of U.S. Route 113, Milford-Georgetown, Sussex County, Delaware.* Draft report prepared for the Location and Environmental Studies Office, Delaware Department of Transportation, Dover, by Louis Berger & Associates, Inc., East Orange, New Jersey.

LeeDecker, Charles H., Martha H. Bowers, Amy Friedlander, Elizabeth W. Rosin, Ingrid Wuebber, and John W. Martin
1992 *Cultural Resource Survey of U.S. Route 113, Milford-Georgetown, Sussex County, Delaware.* Delaware Department of Transportation Archaeology Series 99. Prepared by the Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

LeeDecker, Charles H., Brad Koldehoff, Cheryl Holt, Daniel P. Wagner, Grace S. Brush and Margaret Newman
1991 *Excavation of the Indian Creek V Site (18PR94), Prince Georges County, Maryland.* Prepared for Wallace Roberts & Todd and the Washington Metropolitan Area Transit Authority by the Cultural Resource Group, Louis Berger & Associates, Inc., Washington, D.C.

LeeDecker, Charles H., Jonathan A. Bloom, Ingrid Wuebber, Marie-Lorraine Pipes, and Karen R. Rosenberg
1995 *Final Archaeological Excavations of a Late Eighteenth-Century Family Cemetery for the U.S. Route 113 Dualization, Milford to Georgetown, Sussex County, Delaware.* Delaware Department of Transporation Archaeology Series No. 134. Dover.

Lewis, Thomas M. N., and Madeline Kneberg Lewis
1961 *Eva: An Archaic Site.* University of Tennessee Study in Anthropology, Knoxville.

Louis Berger & Associates, Inc. (LBA)

1986 *Nineteenth Century Wilmington Households: The Christina Gateway Project.* Prepared for the Department of Commerce, City of Wilmington, Delaware, by the Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

1983 *Abbott Farm National Landmark, Phase II Cultural Resource Survey and Mitigation Plan.* Prepared for the Federal Highway Administration and the New Jersey Department of Transportation by the Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

1987 *Gropp's Lake Site (28 Me 100G) Archaeological Data Recovery.* Prepared for the Federal Highway Administration and the New Jersey Department of Transportation by the Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

1992 *Archaeological Excavation at Site 7S-F-68 (Historic Burials) for the Planned U.S. Route 113 Improvements, Milford to Georgetown, Sussex County, Delaware.* Management Summary prepared for Delaware Department of Transportation, Dover, Delaware, by the Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

Lowery, Darrin

1989 The Paw Paw Cove Paleoindian Site Complex, Talbot County, Maryland. *Archaeology of Eastern North America* 17:143-164.

Lowery, Darrin, and Jay F. Custer

1990 Crane Point: An Early Archaic Site in Maryland. *Journal of Middle Atlantic Archaeology* 6:76-120.

Manning, Andrew P.

1994 A Cautionary Note on the Use of Hemastic and Dot-blot Assays for the Detection and Confirmation of Archaeological Blood Residues. *Journal of Archaeological Science* 21(2):159-162.

Martin, Alexander

1972 *Weeds.* Western Publishing Company, Racine, Wisconsin.

Martin, Alexander, and William Barkley

1961 *Seed Identification Manual.* University of California Press, Berkeley.

Medsger, Oliver Perry

1966 *Edible Wild Plants.* Collier Macmillan Publishers, New York, London.

Minnis, Paul E.

1981 Seeds in Archaeological Sites: Sources and Some Interpretive Problems. *American Antiquity* 46:143-151.

Moeller, Roger W.

1986 Theoretical and Practical Considerations in the Application of Flotation for Establishing, Evaluating, and Interpreting Meaningful Archaeological Frameworks. *Journal of Middle Atlantic Archaeology* 2:1-22.

Moerman, Daniel

1986 *Medicinal Plants of Native America.* Research Reports in Ethnobotany, Technical Reports No. 19, vols. 1 and 2. Museum of Anthropology, University of Michigan. Ann Arbor.

Mohlenbrock, Robert

1980 *Flowering Plants: Willows to Mustards.* The Illustrated Flora of Illinois Series. Southern Illinois University Press, Carbondale.

1981 *Flowering Plants: Magnolias to Pitcher Plants.* The Illustrated Flora of Illinois Series. Southern Illinois University Press, Carbondale.

Morris, Percy
1975 *A Field Guide to Shells.* Houghton Mifflin Company, Boston.

Mounier, R. Alan, and John W. Martin
1994 For Crying Out Loud: News About Teardrops. *Journal of Middle Atlantic Archaeology* 10:125-140.

Nelson, Margaret C.
1991 The Study of Technological Organization. In *Archaeological Method and Theory,* edited by M. B. Schiffer, pp. 57-100. University of Arizona Press, Tucson.

Newman, Margaret E.
1990 Letter to Brad Koldehoff concerning results of blood residue analysis for the Indian Creek Site. On file at Louis Berger & Associates, Inc., East Orange, New Jersey.

1993 Immunological Analysis of Artifacts from a Late Woodland Site (7S-F-68), Delaware. On file at Louis Berger & Associates, Inc., East Orange, New Jersey.

Newman, Margaret E., and Patrick Julig
1989 The Identification of Protein Residues on Lithic Artifacts from a Stratified Boreal Forest Site. *Canadian Journal of Archaeology* 13:119-132.

Noel Hume, Ivor
1970 *A Guide to Artifacts of Colonial North America.* Alfred A. Knopf, New York.

O'Connell, James. F.
1987 Alyawara Site Structure and Its Implications for Archaeological Site Structure. *American Antiquity* 52:74-108.

Olsen, Stanley J.
1964 *Mammal Remains from Archaeological Sites.* Papers of the Peabody Museum of Archaeology and Ethnology, vol. 56(1). Harvard University, Cambridge, Massachusetts.

1968 *Fish, Amphibian and Reptile Remains from Archaeolgical Sites.* Papers of the Peabody Museum of Archaeology and Ethnology, vol. 56(2). Harvard University, Cambridge, Massachusetts.

1979 *Osteology for the Archaeologist.* Papers of the Peabody Museum of Archaeology and Ethnology, vol. 56(3, 4, and 5). Harvard University, Cambridge, Massachusetts.

Parry, William J.
1987 *Chipped Stone Tools in Formative Oaxaca, Mexico: Their Procurement, Production, and Use.* Museum of Anthropology Memoir 20. University of Michigan. Ann Arbor.

1989 The Relationship Between Lithic Technology and Changing Mobility Strategies in the Middle Atlantic Region. In *New Approaches to Other Pasts,* edited by W. Fred Kinsey and Roger W. Moeller, pp. 29-34. Archaeological Services, Bethlehem, Connecticut.

Parry, William J., and Robert L. Kelly
1987 Expedient Core Technology and Sedentism. In *The Organization of Core Technology,* edited by J.K. Johnson and C.A. Morrow, pp. 285-304. Westview Press, Boulder, Colorado.

Peck, Rodney M. (editor)
1985 The Williamson Site, Dinwiddie County, Virginia. Published by the editor, Harrisburg, North Carolina.

Peterson, R. L.
1977 *A Field Guide to Edible and Wild Plants of Eastern and Central North America.* Houghton, Boston.

Peterson, Frederick, and Patrick Munson
1984 Amaranth as a Food Resource in the Prehistoric Midwestern United States. In *Experiments and Observations on Aboriginal Wild Plant Food Utilization in Eastern North America,* edited by Patrick Munson, pp. 317-337. Prehistory Research Series, vol. VI, No. 2. Indiana Historical Society.

Popper, Virginia S.
1988 Selecting Quantitative Measurements in Paleoethnobotany. In *Current Paleoethnobotany,* edited by Christine Hastorf and Virginia S. Popper, pp. 53-72. University of Chicago Press, Chicago.

Quick, Clarence R.
1961 How Long Can a Seed Remain Alive? In *Seeds, the Yearbook of Agriculture,* edited by A. Stafferud, pp. 94-99. U.S. Government Printing Office, Washington, D.C.

Renfrew, Colin
1977 Alternative Models for Exchange and Spatial Distribution. In *Exchange Systems in Prehistory,* edited by Timothy K. Earle and Jonathon E. Ericson, pp. 71-90. Academic Press, New York.

Renfrew, J. M.
1973 *Paleoethnobotany: The Prehistoric Food Plants of the Near East and Europe.* Columbia University Press, New York.

Ritchie, William A.
1971 *A Typology and Nomenclature for New York Projectile Points.* Revised edition. Bulletin 348. New York State Museum and Science Service, Albany.

Rogers, E.S.
1973 *The Quest for Food and Furs: The Mistassini Cree, 1953-1954.* Publication in Ethnology 5. National Museum of Canada.

Root, Waverley
1980 *Food.* Simon and Schuster, Inc., New York.

Roper, Donna C.
1979 *Archaeological Survey and Settlement Pattern in Central Illinois.* Illinois State Museum Scientific Papers 16, Illinois State Museum, Springfield, and Special Papers No. 2, Midcontinental Journal of Archaeology.

Ryder, Michael L.
1969 *Animal Bones in Archaeology.* Mammal Society Handbook. Blackwell Scientific Publications, Oxford and Edinburgh.

Schiffer, Michael B.
1972 Archaeological Context and Systemic Context. *American Antiquity* 37:156-165.

1976 *Behavioral Archaeology.* Academic Press, New York.

1987 *Formation Processes of the Archaeological Record.* University of New Mexico Press, Albuquerque.

Schmid, Elizabeth
1972 *Atlas of Animal Bones for Prehistorians, Archaeologists and Quaternary Geologists.* Elsevier Publishing, Amsterdam.

Sheets, Payson D.
1975 Behavioral Analysis and the Structure of a Prehistoric Industry. *Current Anthropology* 16:369-391.

Smith, Bruce D.
1975 *Middle Mississippian Exploitation of Animal Populations.* Anthropological Papers 57. Museum of Anthropology, University of Michigan. Ann Arbor.

1992a *Rivers of Change: Essays on Agriculture in Eastern North America.* Smithsonian Institution Press, Washington, D.C.

1992b Prehistoric Plant Husbandry in Eastern North America. In *The Origins of Agriculture: An International Perspective,* edited by C. Wesley Cowan and Nancy L. Benco, pp. 101-119. Smithsonian Institution Press, Washington, D.C.

Smith, Earle
1946 *The Indians of the Southeastern United States.* Bureau of American Ethnology Bulletin 137.

1985 Recovery and Processing of Botanical Remains. In *The Analysis of Prehistoric Diets,* edited by Robert Gilbert and James Mielke, pp. 97-123. Academic Press, New York.

South, Stanley S.
1977 *Method and Theory in Historical Archaeology.* Academic Press, New York.

Starbuck, David R., and Charles E. Bolian (editors)
1980 *Early and Middle Archaic Cultures in the Northeast.* Occasional Publications in Northeastern Anthropology No. 7. Department of Anthropology, Franklin Pierce College. Rindge, New Hampshire.

Stephenson, Robert L. , Alice L. L. Ferguson, and Henry G. Ferguson
1963 *The Accokeek Creek Site, A Middle Atlantic Seaboard Cultural Sequence.* Anthropological Papers No. 20. Museum of Anthropology, University of Michigan. Ann Arbor.

Steponaitis, Laurie C.
1980 *A Survey of Artifact Collections from the Patuxent Drainage, Maryland.* Maryland Historical Trust Monograph Series No. 1. Annapolis.

Stevenson, Christopher, Maria Klimkiewics, and Barry E. Scheetz
1990 X-Ray Fluorescence of Jaspers from the Woodward Site (36CH374), the Kasowski Site (36CH161, and Selected Eastern United States Jasper Quarries. *Journal of Middle Atlantic Archaeology* 6:43-54.

Steward, Julian H.
1955 *Theory of Culture Change: The Methodology of Multilinear Evolution.* University of Illinois Press, Urbana.

Stewart, Hilary
1982 *Indian Fishing, Early Methods on the Northwest Coast.* University of Washington Press, Seattle.

Stewart, R. Michael
1984a South Mountain (Meta) Rhyolite: A Perspective on Prehistoric Trade and Exchange in the Middle Atlantic Region. In *Prehistoric Lithic Exchange Systems in the Middle Atlantic Region,* edited by Jay F. Custer, pp. 14-44. Monograph No. 3. Center for Archaeological Research, University of Delaware. Newark.

1984b Archaeologically Significant Characteristics of Maryland and Pennsylvania Rhyolites. In *Prehistoric Lithic Exchange Systems in the Middle Atlantic Region,* edited by Jay F. Custer. Center for Archaeological Studies, University of Delaware, Newark.

1987 Rhyolite Quarry and Quarry-Related Sites in Maryland and Pennsylvania. *Archaeology of Eastern North America* 15:47-57.

1989a The Middle Archaic of Western Maryland. Paper presented at the Annual Meeting of the Eastern States Archaeological Federation, East Windsor, Connecticut.

1989b Trade and Exchange in Middle Atlantic Region Prehistory. *Archaeology of Eastern North America* 17:47-78.

1990 The Middle Archaic Period in the Great Valley of Maryland. Paper presented at the Middle Atlantic Archaeological Conference. Ocean City, Maryland.

Stewart, R. Michael, and John Cavallo
1991 Delaware Valley Middle Archaic. *Journal of Middle Atlantic Archaeology* 7:19-42.

Stewart, R. Michael, Chris Hummer, and Jay Custer
1983 Late Woodland Cultures of the Middle and Lower Delaware Valley and the Upper Delmarva Peninsula. Paper presented at the Middle Atlantic Archaeological Conference. Rehoboth Beach, Delaware.

Tantaquidgeon, Gladys
1977 *Folk Medicine of the Delaware and Related Algonkian Indians.* Anthropological Series No. 3. The Pennsylvania Historical and Museum Commission. Harrisburg.

Taylor, Randolph, and Brad Koldehoff
1991 A Guide to LITHICA: An R-BASE Lithic Analysis System. On file with the Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

Thomas, David H.
1986 Points on Points: A Reply to Flenniken and Raymond. *American Antiquity* 51:619-627.

Thomas, Ronald A.
1966 The Delaware Archaeological Board Site Survey: A Progress Report. *Delaware Archaeology* 2(1):2-15.

Thomas, Ronald A., Daniel R. Griffith, Cara L. Wise, and Richard E. Artusy, Jr.
1975 Environmental Adaptation on Delaware's Coastal Plain. *Archaeology of Eastern North America* 3:35-90.

Tiner, Ralph
1987 *A Field Guide to Coastal Wetland Plants of the Northeastern United States.* The University of Massachusetts Press, Amherst.

Tucker, John, and Johnathan Sauer
1958 Aberrant Amaranthus Populations of the Sacramento-San Joaquin Delta, California. *Madrono* 14(8):252-61.

von den Driesch, Angela
1976 *A Guide to the Measurement of Animal Bones from Archaeological Sites.* Peabody Museum Bulletins No. 1. Harvard University, Cambridge, Massachusetts.

Vogel, Virgil
1970 *American Indian Medicine.* University of Oklahoma Press, Norman and London.

Vokes, Harold E., and Jonathan Edwards, Jr.
1974 Geography and Geology of Maryland. Revised Edition. Maryland Geological Survey Bulletin No. 9. Maryland Department of Natural Resources. Baltimore.

Wagner, Daniel P.
1990 *Pedological and Geomorphological Investigations of the Indian Creek Site (18PR94).* Prepared for Louis Berger & Associates, Inc., by Geo-Sci Consultants, Inc., College Park, Maryland.

1992 *Pedological and Geomorphological Investigations of Site 7SF68 Near Georgetown, Delaware.* Prepared for Louis Berger & Associates, Inc., by Geo-Sci Consultants, Inc., College Park, Maryland.

Wall, Robert
1993 Personal communication. The Cultural Resource Group, Louis Berger & Associates, Inc., East Orange, New Jersey.

Wanser, Jeffrey C.
1982 *A Survey of Artifact Collections from Central Southern Maryland.* Maryland Historical Trust Manuscript Series No. 23. Annapolis.

Ward, H. Henry
1988 Prehistoric Utilization of Ironstone in the Central Middle Atlantic. *Pennsylvania Archaeologist* 58(1):7-25.

Waselkov, Gregory A.
1982 *Shellfish Gathering and Shell Midden Archaeology.* Ph.D. dissertation, Department of Anthropology, The University of North Carolina, Chapel Hill.

Watt, W. A.
1979 Late Glacial Vegetation of Central Appalachia and the New Jersey Coastal Plain. *Ecological Monographs* 49:427-469.

Waugh, F. W.
1973 *Iroquois Foods and Food Preparation.* Reprinted. Geological Survey Memoir 86. Canada Deptartment of Mines. Originally published 1916.

Weslager, Clinton A.
1968 *Delaware's Buried Past: A Story of Archaeological Adventure.* Second Edition. Rutgers University Press, New Brunswick, New Jersey.

Wesler, Kit W.
1983 Typology and Sequence in the Maryland Archaic. *Southeastern Archaeology* 2(1):21-29.

1985 Model and Sequence in the Maryland Archaic. In *Structure and Process in Southeastern Archaeology,* edited by Roy S. Dickens and Trawick Ward, pp. 212-228. University of Alabama Press,

Wetterstrom, Wilma
1978 Energy Capture Analysis. In *Prehistoric Patterns of Human Behavior,* edited by Bruce Smith, pp. 99-117. Academic Press, New York.

White, Leslie A.
1959 *Energy and the Evolution of Culture: The Development of Civilization to the Fall of Rome.* McGraw-Hill, New York.

Wildesen, Leslie
1982 The Study of Impacts on Archaeological Sites. In *Advances in Archaeologcial Method and Theory,* vol. 5 , edited by Michael B. Schiffer, pp. 51-83. Academic Press, New York.

Wilkins, E. S.
1976 The Lithics of the Delmarva and Nanticoke Indians. *Transactions of the Delaware Academy of Sciences* 74:24-35.

Wilson, Hugh
1976 *Identification of Archaeological Chenopodium Material from Eastern North America.* The Botanical Society of America Abstracts of Papers No. 64.

Wing, Elizabeth, and A. Brown
1979 *Paleonutrition.* Academic Press, New York.

Winters, Howard D.
1969 *The Riverton Culture: A Second Millennium Occupation of the Central Wabash Valley.* Reports of Investigation 13. Illinois State Museum, Springfield.

Wood, W. Raymond, and Donald L. Johnson
1978 A Survey of Disturbance Processes in Archaeological Site Formation. In *Advances in Archaeological Method and Theory,* vol. 1, edited by Michael B. Schiffer, pp. 315-383. Academic Press, New York.

Yarnell, Richard
1972 *Iva Annua var. macrocarpa:* Extinct American Cultigen? *American Anthropologist* 74:335-41.

1978 Domestication of Sunflower and Sumpweed in Eastern North America. In *The Nature and Status of Ethnobotany,* edited by Richard I. Ford, pp. 289-99. Anthropological Papers No. 67. Museum of Anthopology, University of Michigan. Ann Arbor.

1964 *Aboriginal Relationships Between Culture and Plant Life in the Upper Great Lakes Region.* Anthropological Papers No. 23. Museum of Anthropology, University of Michigan, Ann Arbor.

1965 Early Woodland Plant Remains and the Question of Cultivation. *Florida Anthropologist* 18:77-82.

Yarnell, Richard A., and Jean M. Black
1985 Temporal Trends Indicated by a Survey of Archaic and Woodland Plant Food Remains from Southeast North America. *Southeastern Archaeology* 4(2):93-106.

Yellen, John E.
1977 *Archaeological Approaches to the Present: Models for Reconstructing the Past.* Academic Press, New York.

Yerkes, Richard R.
1987 *Prehistoric Life on the Mississippi River Floodplain: Stone Tool Use, Settlement Organization, and Subsistence at the Labras Lake Site.* University of Chicago Press, Chicago.

GLOSSARY

aeolian - wind-borne.

anadromous - fish that ascend rivers upward from the sea for breeding, such as salmon, shad, or sturgeon.

argillite - a metamorphosed mudstone cemented by silica and lacking slaty cleavage.

assemblage - collection of persons or things; in this context, the collection of artifacts from a particular site, from a stratigraphic level or cultural component within the site, or of a particular artifact class, such as lithics or ceramics.

biface - a stone tool bearing flake scars on both faces.

bipolar - lithic manufacturing technique of resting core on anvil and striking the core with a percussor; bipolar flakes typically exhibit sheared cones of force, diffuse bulbs of percussion, closely spaced ripple marks, and crushed and splintered platforms; bipolar cores are typically tabular in shape, exhibit heavy crushing and battering, and flake scars tend to be oriented along the long axis of the core.

catchment area - the area exploited for resources by the local population.

chalcedony - a cryptocrystalline variety of quartz, predominantly silica and having the near luster of paraffin wax; may be transparent or translucent and of various colors.

chert - a fine-grained, siliceous, sedimentary rock, generally light-colored; an impure variety of chalcedony resembling flint.

chronology - pertains to the basic temporal units of prehistory and the time span reflected in archaeological site stratigraphy.

cobble tool - cobbles used for various tasks with little or no prior modification; battered, crushed, pitted, and/or smoothed surfaces identify these cobbles as tools.

core - nucleus; a mass of lithic material often shaped by the worker to allow the removal of a definite type of flake or blade.

cortex - natural rind or weathered outer layer on flint-like materials; observations of cortex provide information on tool manufacturing techniques and on methods of raw material procurement: presence of cortex indicates early- to middle-stage tool manufacturing activity.

cracked rock - includes all fragments of lithic debris that cannot be attributed to stone tool production; represents cobbles and/or chunks of local bedrock that may have been used in heating or cooking activities (fire-cracked rock).

cultigen - a cultivated plant for which a wild ancestor is known, for example, corn.

debitage - residual lithic material resulting from tool manufacture; represents intentional and unintentional breakage of artifacts either through manufacture or function; debitage flakes may represent the various stages of progress of the raw material from the original form to the finished tool.

edge damage - known by a variety of terms including "microflaking" and "utilization damage," this refers to the scars created along the edge of a utilized tool; visible as tiny flakes removed from the utilized surface.

expedient tool - a tool produced casually or opportunistically from readily available material, including cobbles, pebbles, or large waste flakes from formal tool manufacture; expedient tools are characterized by little, if any, modification prior to use.

faunal remains - includes both bone and shell refuse, as well as tools and ornaments.

floral remains - include both charred and uncharred plant materials such as seeds, nuts, shells, and wood.

flotation - process of sifting soil samples through a fine screen while running a steady stream of water over the sample; residual materials such as tiny artifacts, seeds, and bones are separated out into light and heavy fractions for analysis.

geomorphology - the study of landforms; concentrates on both the description of landforms, as well as the chemical and physical processes that create the features present at the surface of the earth.

groundstone tools - formal stone tools and ornaments that were manufactured by pecking, grinding, and sometimes flaking.

intrasite patterning - horizontal and vertical site structure; focuses on the delineation of task- specific activity areas and site formation processes.

ironstone - a hard sedimentary rock high in iron content such as siderite.

jasper - an opaque cryptocrystalline quartz of a variety of colors, usually yellowish brown to reddish brown.

lithic - of, related to, or made of stone.

palynology - a specialized form of botanical analysis which examines residual pollen and spores.

pedology - a branch of geology that focuses on the study of soils and soils development.

plowzone - that portion of the stratigraphy in which plowing has taken place; generally abbreviated as the 'Ap-horizon'.

quartz - crystalline, non-metallic, mineral consisting of silicon dioxide; typically occurs in hexagonal crystals or crystalline masses.

quartzite - a compact granular rock composed of quartz and derived from sandstone by heat and pressure.

residue analysis - chemical analysis of a variety of use-related, protein-based residues present on lithic and ceramic artifacts; includes animal remains such as blood and fish oil or plant products such as seeds, grains, and sap.

rhyolite - light colored, extrusive, igneous rock with abundant quartz and a very fine-grained texture.

settlement pattern - pertains to a group's adaptation to the environment within a regional perspective.

stratigraphy - the origin, composition, and succession of natural soil or rock or cultural layers.

stratum - (i) a mass of sedimentary deposits laying in a vertical sequence; (ii) a layer in which archaeological material (as artifacts or dwelling remains) is found within a site.

steatite - soapstone; fine-grained, relatively soft, compact rock whose principal constituent is talc.

subsistence - a source or means of obtaining those materials essential to the maintenance of life such as food and shelter; in archaeology, subsistence deals primarily with dietary composition and food procurement strategies.

temper - in pottery manufacture, temper is the material added to the clay that modifies its properties when wet or dry, as well as during and after firing; can include fiber, shell, grit, sand, or fragments of fired clay.

uniface - a stone tool flaked on one surface only.

waste flake - discarded lithic flakes not suitable for use; usually resulting from platform preparation, trimming, quarrying or mining waste, and removal of cortex.

PERSONNEL

John A. Hotopp, Project Manager
Director and Principal Archaeologist, Louis Berger & Associates, Inc. B.A. in Economics and Political Science, Morris Harvey College. M.A. in Political Science, Marshall University. Ph.D. in Anthropology, University of Iowa. Twenty years of experience in archaeological research and administration.

Charles H. LeeDecker, Principal Investigator
Senior Archaeologist, Louis Berger & Associates, Inc. B.A. in Anthropology at Cornell University. M.A. in Anthropology, The George Washington University. Seventeen years of experience in archaeological research in the Middle Atlantic and Southeast.

Brad Koldehoff, Lithic Analyst
B.A and M.A. in Anthropology, Southern Illinois University. Sixteen years of experience in archaeology.

Cheryl A. Holt, Floral and Faunal Analyst
B.A. in Anthropology ,The George Washington University. M.A. in Anthropology at Case Western University. Ph.D. coursework completed at Brandeis University. Twenty years of experience in archaeology, specializing in floral and faunal analysis.

Dianne Anderson, Field Crew
B.A. in Anthropology and Geography, University of South Carolina. Three years of experience in archaeological fieldwork and laboratory studies.

Lisa Adams, Field Crew
B.S. in Geography, University of Wisconsin. M.A. candidate at Eastern New Mexico University. Nine years of experience in archaeology.

Christine Ahlstrom, Laboratory Technician
B.A. in Physical Anthropology, University of California at Davis. Two years of experience in the laboratory processing of archaeological collections.

Ayubu Azizi, Laboratory Technician
Three year of experience in laboratory processing of archaeological collections.

Sharla C. Azizi, Laboratory Supervisor
B.F.A. candidate, University of Houston. Nine years of experience in archaeology.

Nathaniel Bailey, Field Crew
B.A. in Archaeology and History, University of Virginia. Two years of experience in archaeology.

Trisha Banks, Laboratory Technician
B.A. candidate at Kean State College. Five years of experience in archaeology.

Janet Bjugan, Laboratory Assistant
B.A. in Anthropology, Rutgers University. One year of experience in the laboratory processing of archaeological collections.

Bradford Botwick, Field Supervisor
B.A. in Anthropology at Rutgers University. M.A. in Anthropology/Public Service Archaeology, University of South Carolina. Eight years of experience in archaeology.

Beverly Boyko, Laboratory Assitant
B.A. in Anthropology, University of Winnipeg. Ten years of experience in archaeology.

Gary Charyak, Field Crew
B.A. in Liberal Studies and Social Sciences, William Paterson College. One year of experience in archaeology.

Peter Condon, Field Crew
B.A. in Anthropology/Archaeology, State University College at Plattsburg, New York. Three years of experience in archaeological excavation and laboratory analysis.

Charles Dunton, Field Crew
B.S. candidate at Texas Southern University. Eight years of experience in archaeology.

Laura Elsinger, Field Crew
B.S. in Biology, University of Iowa. Two years of experience in archaeology.

Charles Fiaschetti, Laboratory Assistant
Six years of experience in laboratory processing and cataloging of archaeological collections.

Eric Filkins, Field Crew
B.A. in Anthropology, Gannon University. M.A. candidate at Ball State University. Nine years of experience in archaeology.

Stephen Fisher, Computer Programmer
B.S. in Management Information Science, Seton Hall University. Five years of experience in archaeological applications of computer database design and management.

Kathy Fobes, Field Crew
B.A. in Anthropology, Cleveland State University. Six years of experience in archaeology.

Paul Freidman, Field Crew
B.A. in Anthropology and Biology, State University of New York at Albany. Two years of experience in archaeology.

Melissa Grieves, Laboratory Technician
B.A. in Anthropology, Arizona State University. One year of experience in archaeology.

Sharon Hogue, Field Crew
B.A. in Anthropology, Pennsylvania State University. One year of experience in archaeology.

Jacqueline Horsford, Drafting Supervisor
B.S. in Geography, Pennsylvania State University. Five years of experience in drafting and cartography.

Rob Jacoby, Field Crew
B.A. in Anthropology, Northwestern University. Ph.D candidate in Anthropology at SUNY-Binghamton.

Jason Janowitz, Laboratory Technician
Two year of experience in laboratory processing of archaeological collections.

Scott Jones, Field Crew
B.A. in Anthropology, Auburn University. Three years of experience in archaeology.

Ronald Kearns, Laboratory Assistant
B.A. in Archaeology, Rutgers University. Four years of experience in archaeology.

Charlene Keck, Field Crew
B.A. in Anthropology, State University of New York at Oswego. Three years of experience in archaeology.

Alan Kinner, Field Crew
Three years of experience in archaeology.

Andria Kinner, Field Crew
B.A. in Sociology/Anthropology, Mansfield University. Three years of experience in archaeology.

Kimberly Kratzer, Field Supervisor
B.A. in Anthropology, Kutztown University. M.A. in History, Lehigh University. Seven years of experience in archaeology.

Linda Lipka, Drafting
DuCret School of Fine and Industrial Arts. Fifteen years of professional experience in graphic arts.

Yvonne McCanns, Field Crew
B.A. in Anthropology, State University of New York at Potsdam. One year of experience in archaeology.

Nadia Maczaj, Assistant Laboratory Supervisor
B.A. in History, Rutgers University. Seven years of experience in archaeology.

Valerie Moore, Assistant Editor
B.A. in English at Rutgers University. Three years of experience in the editing of technical reports.

Lee Nicoletti, Production Supervisor
Business Administration at Bloomfield College. Eleven years of experience in technical report production.

Alex Ortiz, Laboratory Technician
Degree in Mathematics,Universidad Centroamericana "Jose Simeon Canas," El Salvador.

Veronica Noselli, Editorial Assistant
B.A. in English, Syracuse University. Two years of editing experience.

Earl Proper, Field Crew
B.A. in Business Administration, Lenoir-Rhyne College. Seven years of experience in archaeology.

John Ra, Laboratory Technician
B.A. in Anthropology, Rutgers University.

Lenore Santone, Archaeologist
B.A. in English, University of Pennsylvania. M.A. in Anthropology, Bryn Mawr College. Ph.D. in Anthropology, University of Texas, Austin. Eight years of experience in archaeology.

Robert Shaw, Laboratory Technician
B.A. in Anthropology and History, Newark College of Arts and Sciences, Rutgers University. One year of experience in laboratory processing of archaeological collections.

Byron Simmons, Laboratory Assistant
Seven years of experience in laboratory processing of archaeological collections.

Madge Smith, Field Crew
B.A. in Anthropology at Southern Illinois University. M.S. in Community Development. Two years of experience in archaeology.

Suzanne Szanto, Editor
B.A. in English, Albertus Magnus College. Seven years of experience in the editing and production of cultural resource management reports.

Christina Szoke, Laboratory Technician
One year of experience in the laboratory processing of archaeological collections.

Rob Tucher, Photographer

B.A. in Communications, Rutgers University. Ten years of experience in professional photography of archaeological subjects.

Rick Vernay, Crew Chief

B.S. in Chemistry, Lehigh University. Three years of experience in archaeology.

Kimberly Williams, Assistant Editor

B.A. in Archaeology, Columbia College. One year of experience in archaeology.

Ingrid Wuebber, Historian

B.A. in Archaeology, Douglass College, Rutgers University. Twelve years of experience in archaeology and historical research.

APPENDIX A

Public Information Handout

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
P.O. BOX 778
DOVER, DELAWARE 19903

THOMAS R. CARPER
GOVERNOR

ARCHAEOLOGICAL EXCAVATIONS ALONG U.S. ROUTE 113

The Delaware Department of Transportation (DelDOT), in conjunction with The Cultural Resource Group of Louis Berger & Associates, Inc., is conducting an archaeological excavation program at a small prehistoric campsite near Redden. DelDOT plans to improve U.S. Route 113 between Georgetown and Milford by the addition of two additional travel lanes, which will alleviate traffic congestion and safety deficiencies.

DelDOT's planning studies included a survey for historic properties along the Route 113 corridor, and this resulted in the identification of seven archaeological sites, in addition to a number of historic buildings. In 1991, preliminary excavations were completed at the seven archaeological sites, and one site, designated 7S-F-68, was determined to merit additional excavation before construction of the new roadway.

The site chosen for excavation is located just south of Redden Crossroads. According to the Delaware state plan for management of archaeological resources, there is very little information available concerning prehistoric settlement in this area. The present excavations will therefore help to fill a gap in our knowledge of Delaware prehistory. Site 7S-F-68 was used repeatedly by prehistoric groups, beginning as early as 6500 B.C. and continuing until the period of historic settlement. There are no streams nearby that might have provided a source of water or facilitated travel, although there is a small wetland to the south of the site that might have attracted game or provided important plant foods. It is believed that prehistoric groups used the site only for brief visits and that these groups would have maintained their larger, more permanent camps or villages in the lower reaches of streams that flowed into the Chesapeake or Delaware Bays.

The 1992 excavations will focus on the exposure of large block areas within the site, in order to recover information concerning the internal structure of the campsite. Most of the material recovered consists of pottery fragments and debris from the manufacture and reshaping of stone tools. Discarded tools such as hide scrapers, spear points, and milling stones are also found at the site. Cooking areas are also preserved in the form of charcoal stains. After excavation, the recovered material will be cataloged and a number of specialized tests will be undertaken to assist in dating the periods of occupation, the types of animals that were hunted, and the types of vegetable foods that were used at the site.

If you would like additional information concerning the project, please contact Kevin Cunningham, DelDOT Archaeologist, at 739-4642 or Charles LeeDecker at the site.

DelDOT

APPENDIX B

Prehistoric Artifact Catalog

This material is available at the agencies listed below:

Archaeology Laboratory
Louis Berger & Associates, Inc.
100 Halsted Street
East Orange, NJ 07019
Contact: Sharla Azizi, Laboratory Supervisor
(201) 678-1960

Delaware Department of Transportation
Division of Highways
U.S. Route 113
Dover, DE 19903
Contact: Kevin Cunningham, Archaeologist
(302) 739-4644

Please note the Tables of information on pages 61, 62, 63, 64, 73, 75, 80, 81 and 82.

APPENDIX C

Floral and Faunal Catalog

This material is available at the agencies listed below:

Archaeology Laboratory
Louis Berger & Associates, Inc.
100 Halsted Street
East Orange, NJ 07019
Contact: Sharla Azizi, Laboratory Supervisor
(201) 678-1960

Delaware Department of Transportation
Division of Highways
U.S. Route 113
Dover, DE 19903
Contact: Kevin Cunningham, Archaeologist
(302) 739-4644

Please note the Tables of information on pages 124, 126, 127, 128, 129, 139 and 141.